

Fig 1

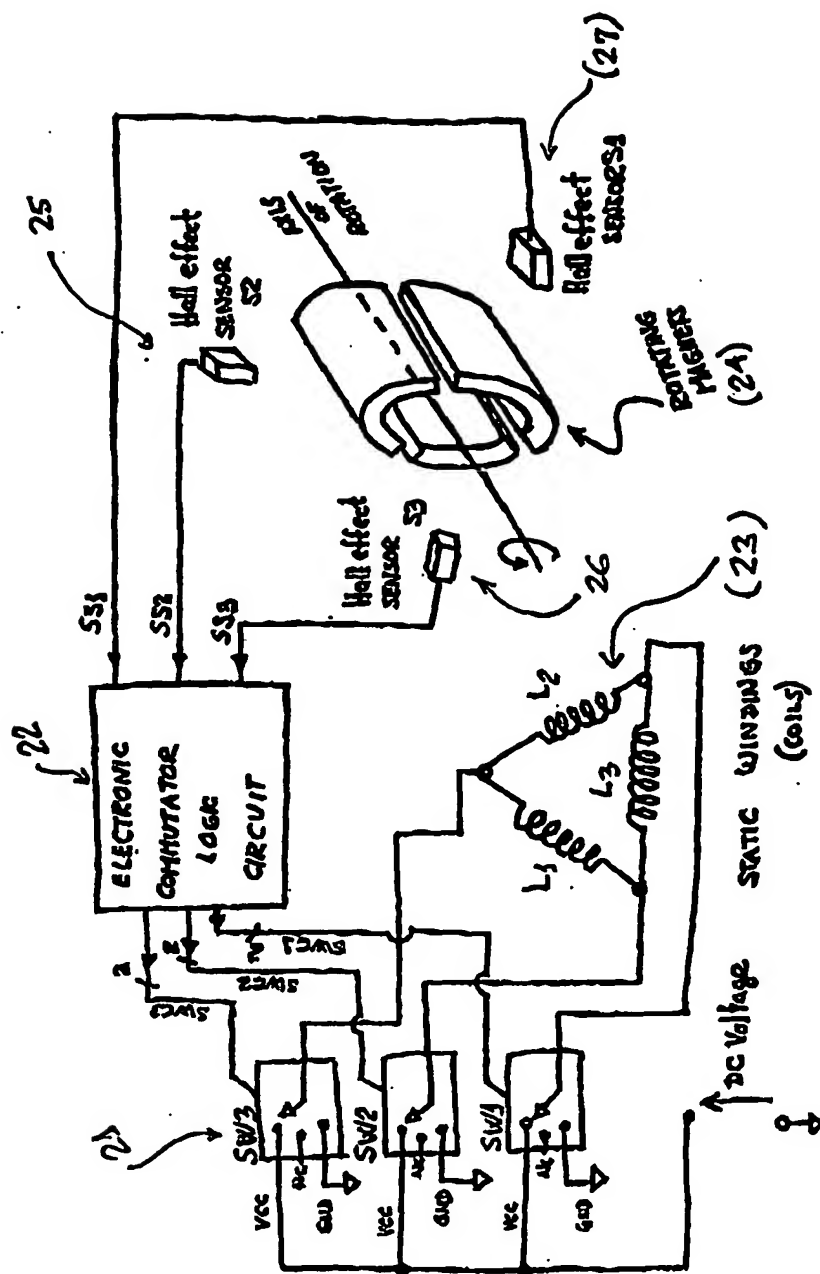


Fig 2

Permanent magnet brushless DC motor

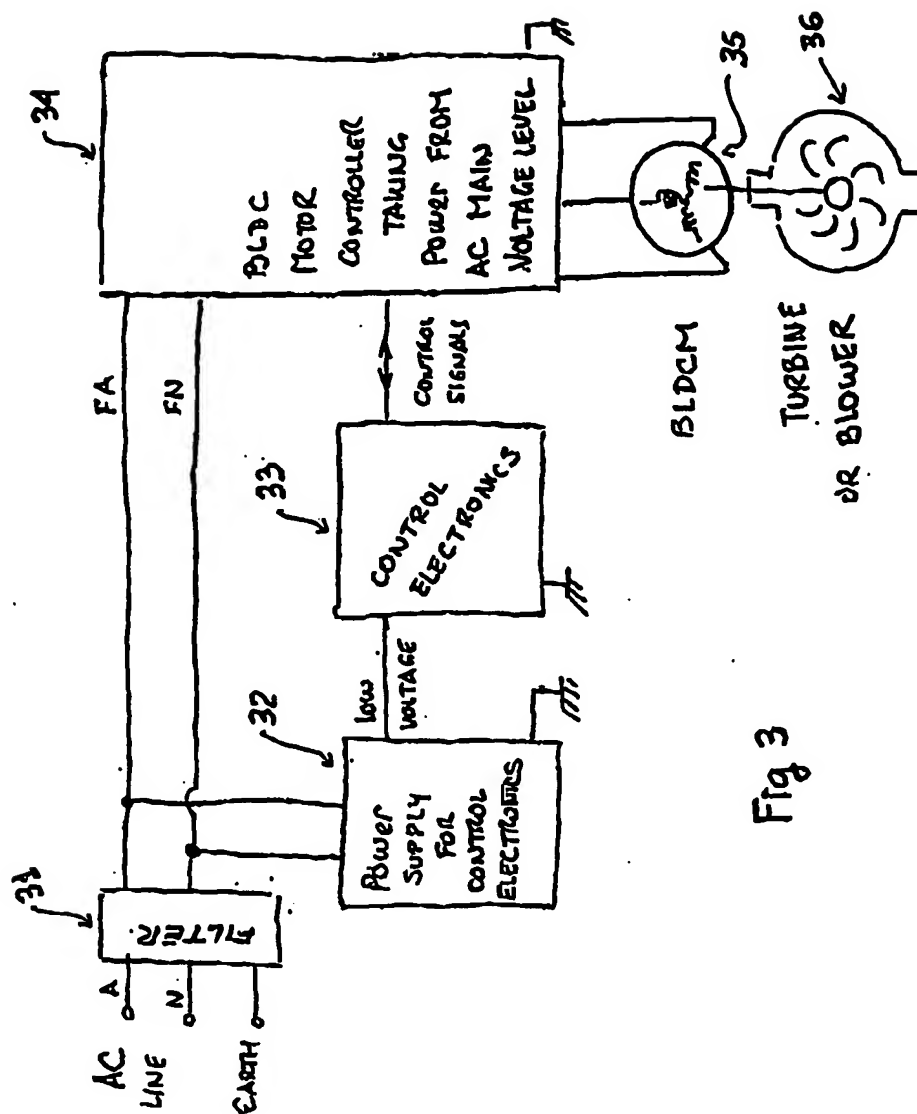


Fig 3

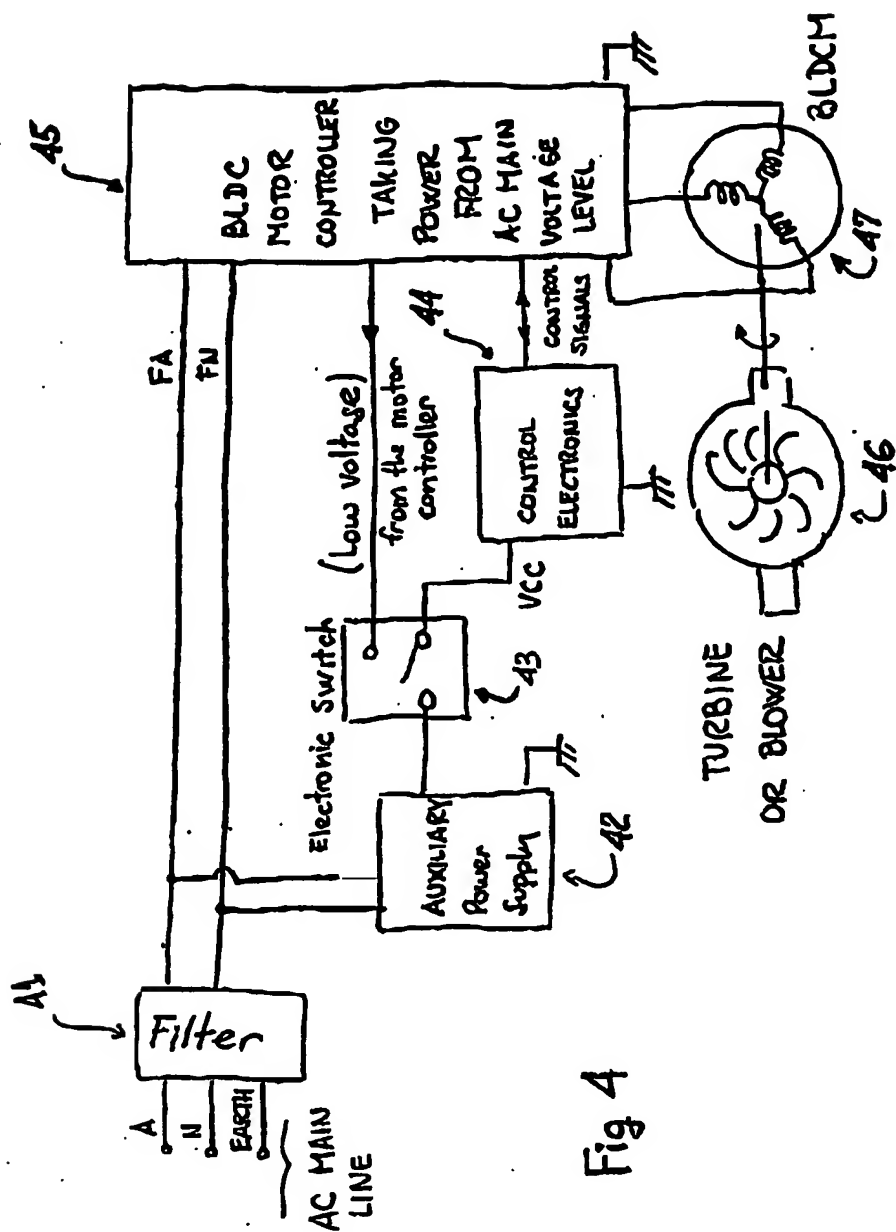


Fig 4

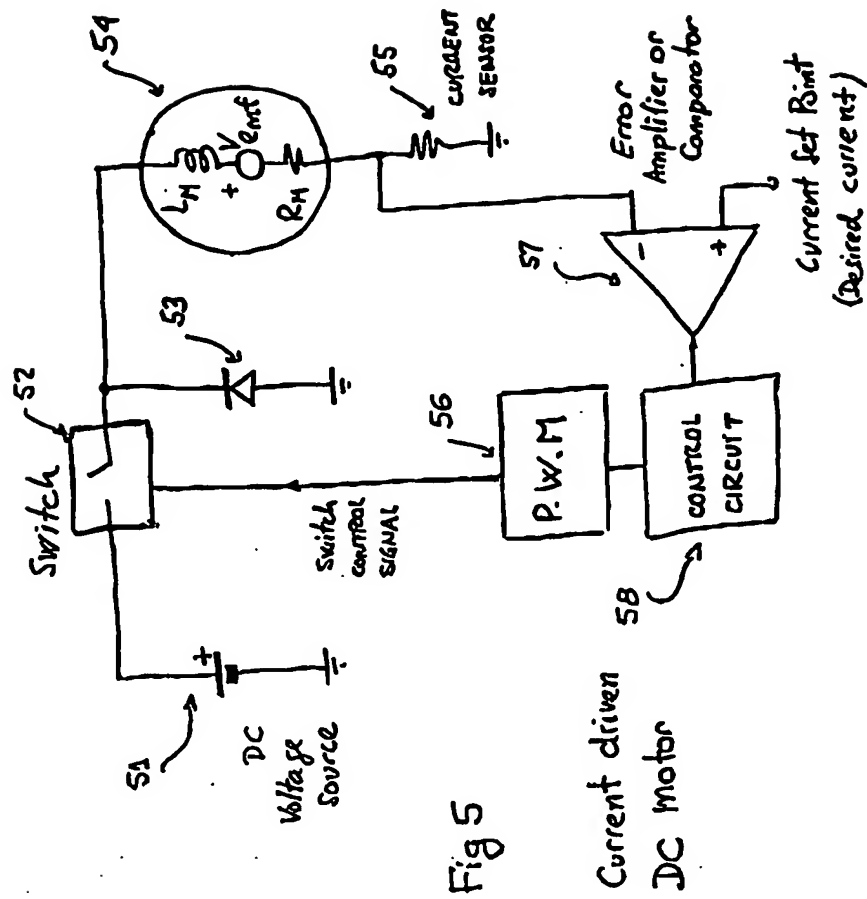
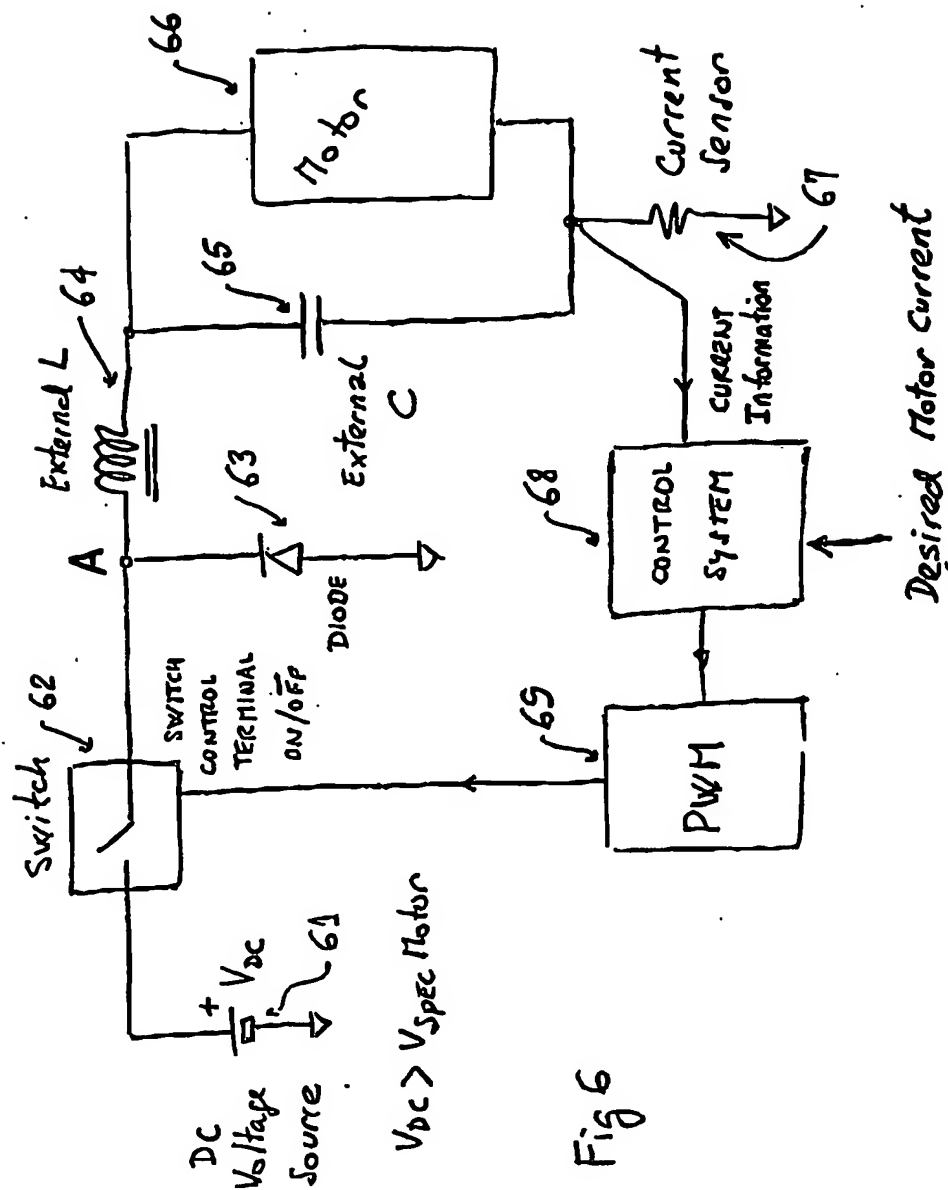
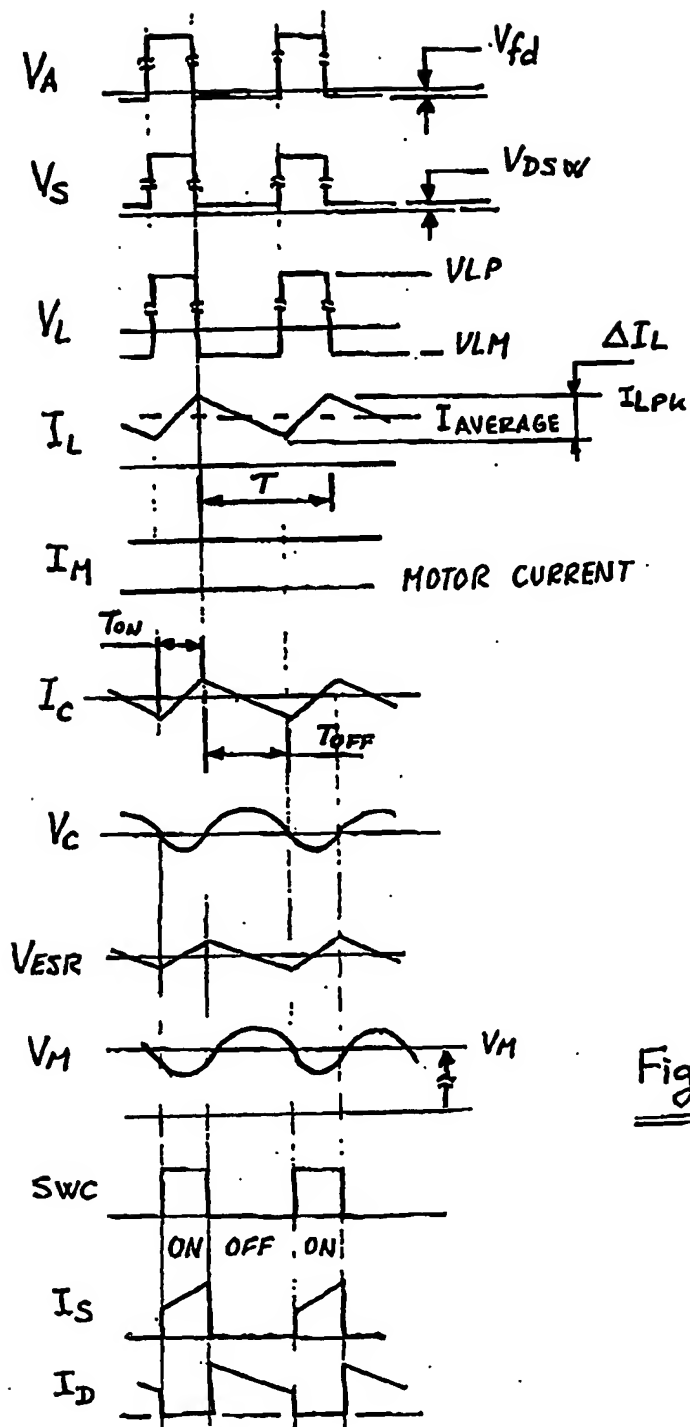


Fig 5

Current driven  
DC motor



Fig. 6A

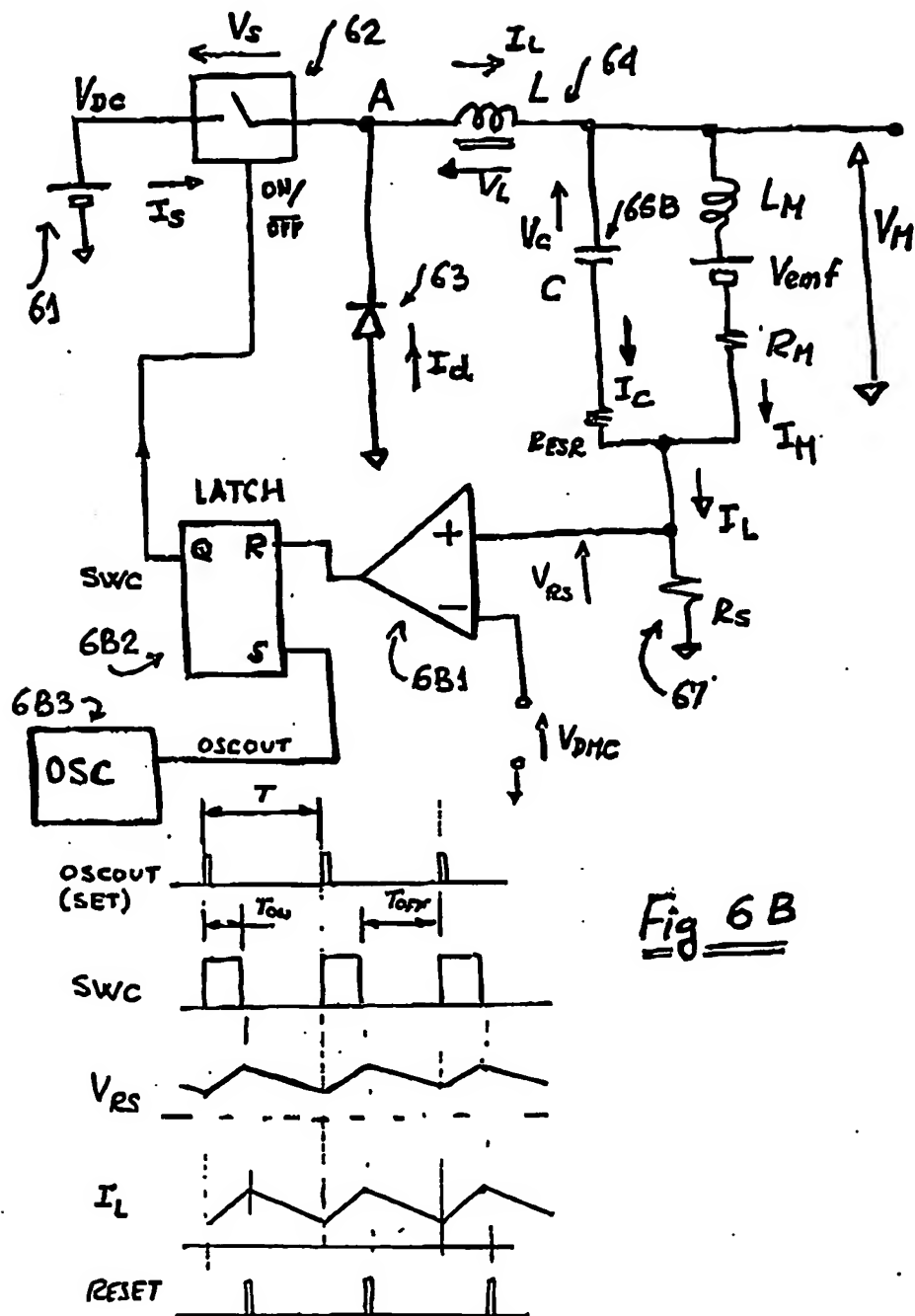
Fig 6B



Fig 6C-1

- 1)  $V_S = V_{DC} - V_A$
- 2)  $V_L = V_A - V_M$
- 3)  $V_M \cong I_M R_M + V_{emf}$
- 4)  $V_{emf} = k_v \omega_M$
- 5)  $I_S = I_L$
- 6)  $I_L = I_C + I_M$
- 7)  $I_L = V_{RS} / R_S$
- 8)  $V_M = V_C + I_C R_{ESR}$
- 9)  $T = T_{ON} + T_{OFF}$
- 10)  $I_L = I_{AVERAGE} + I_L(t)$
- 11)  $I_{L PK} = I_{AVERAGE} + \Delta I_L / 2$
- 12)  $I_{L MIN} = I_{AVERAGE} - \Delta I_L / 2$
- 13)  $I_M = I_{AVERAGE}$
- 14)  $I_C = I_L(t)$
- 15)  $I_L(t) = \frac{1}{L} \int V_L(t) dt$
- 16)  $I_L = \frac{V_L}{L} t = \frac{V_A - V_M}{L} t$
- 17)  $I_L = \frac{V_{DC} - V_S - V_M}{L} t$

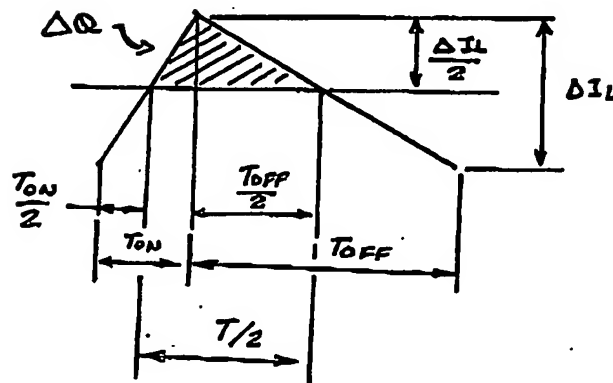
$$18) \Delta I_L = \frac{V_{DC} - V_S - V_{TH}}{L} T_{ON} \quad \text{Fig 6C-2}$$

$$19) |\Delta I_L| = \frac{V_{TH} + V_{fsl}}{L} T_{OFF}$$

$$20) \frac{V_{DC} - V_S - V_{TH}}{L} T_{ON} = \frac{V_{TH} + V_{fsl}}{L} T_{OFF}$$

$$21) (V_{DC} - V_{TH}) T_{ON} \cong V_{TH} T_{OFF}$$

$$22) V_{TH} \cong V_{DC} \frac{T_{ON}}{T_{ON} + T_{OFF}} = V_{DC} \frac{T_{ON}}{T}$$



$$23) \Delta Q = \frac{1}{2} \cdot \frac{T}{2} \cdot \frac{\Delta I_L}{2}$$

$$24) \Delta V_{Cc} = \frac{\Delta Q}{C} = \frac{\Delta I_L}{f 8 C}$$

$$25) \Delta V_C = \Delta V_{Cc} + \Delta I_L R_{ESR}$$

$$26) \Delta V_C \ll V_{TH}$$

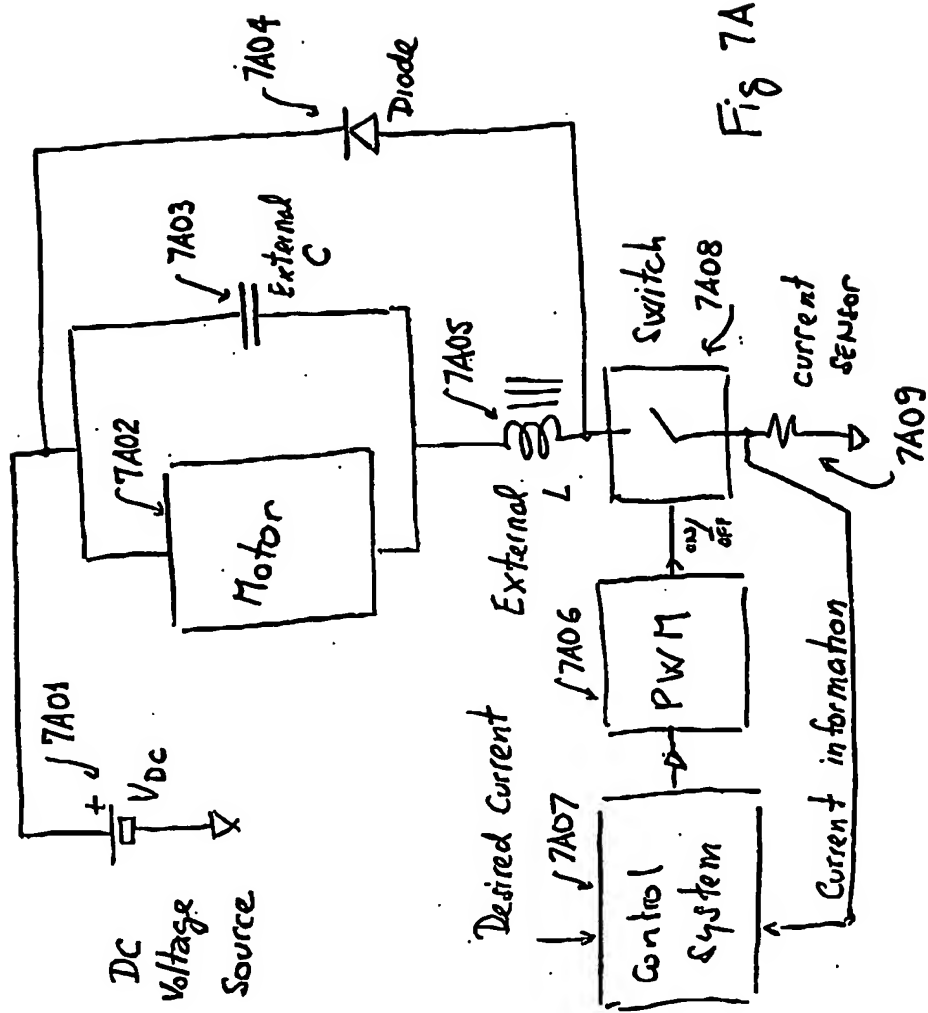


Fig 7A

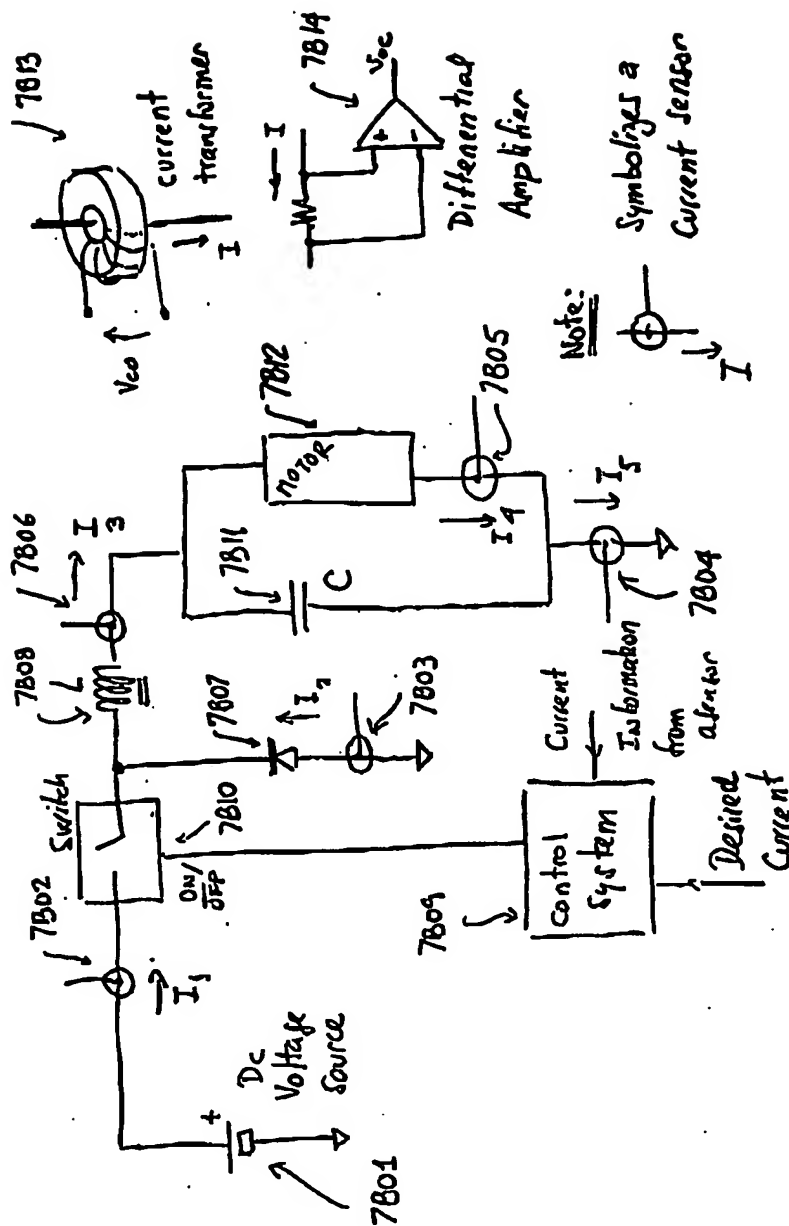


Fig 7B

Positions of current sensors

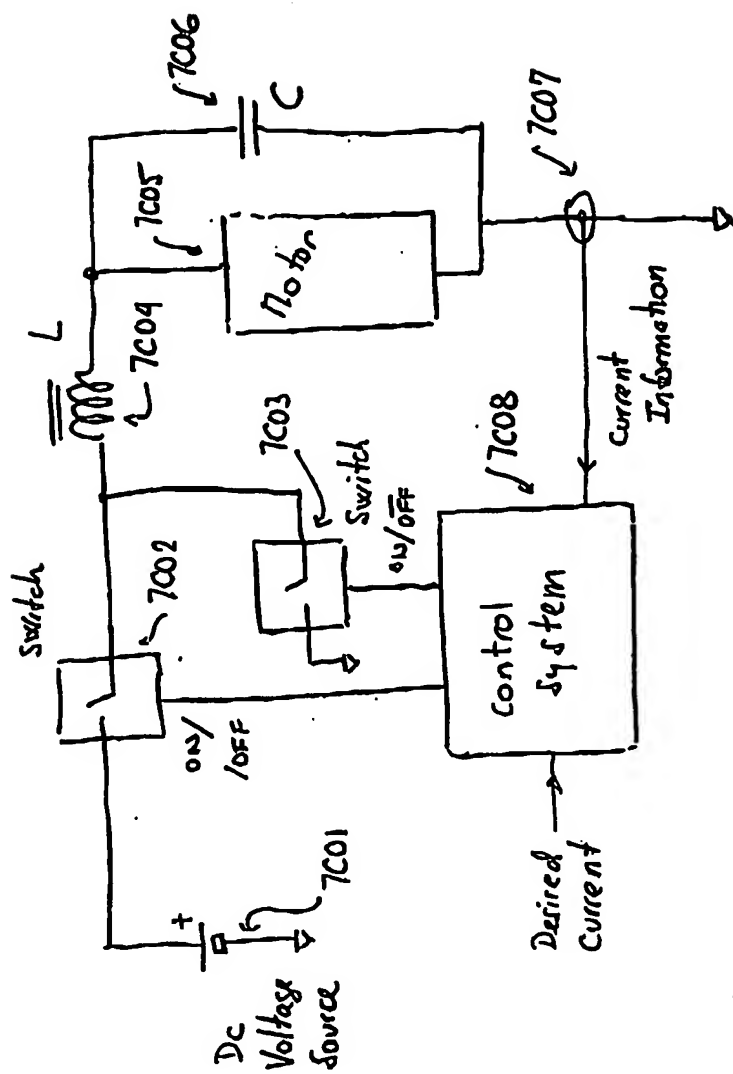
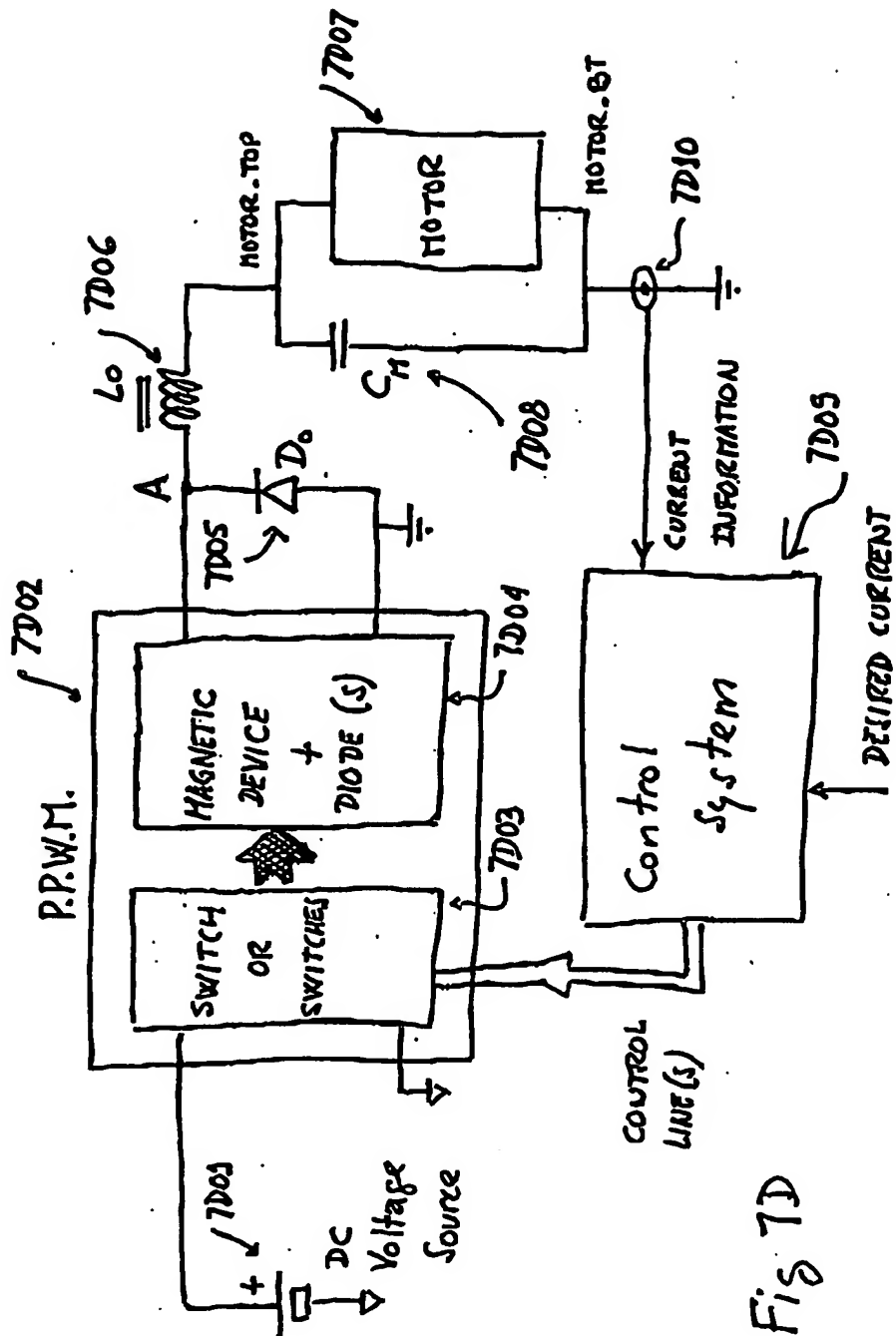
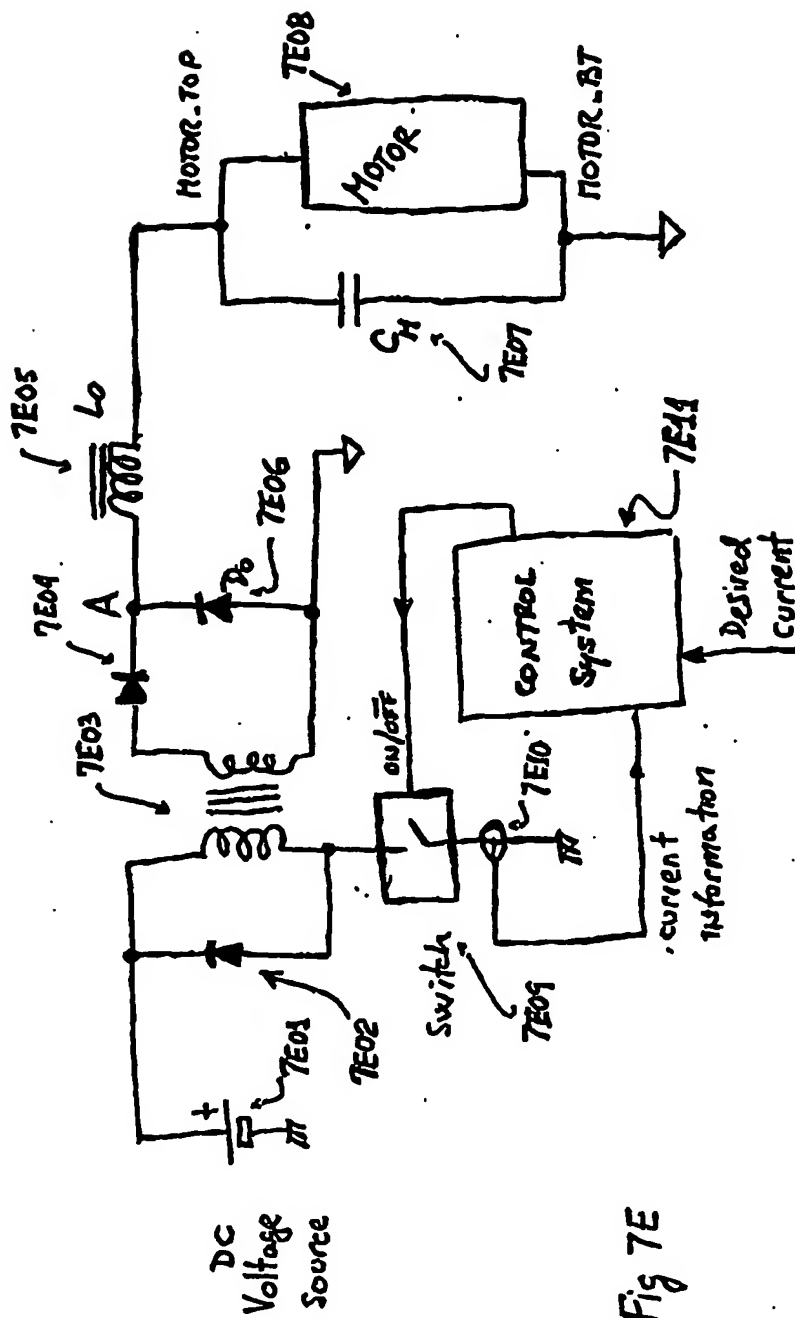
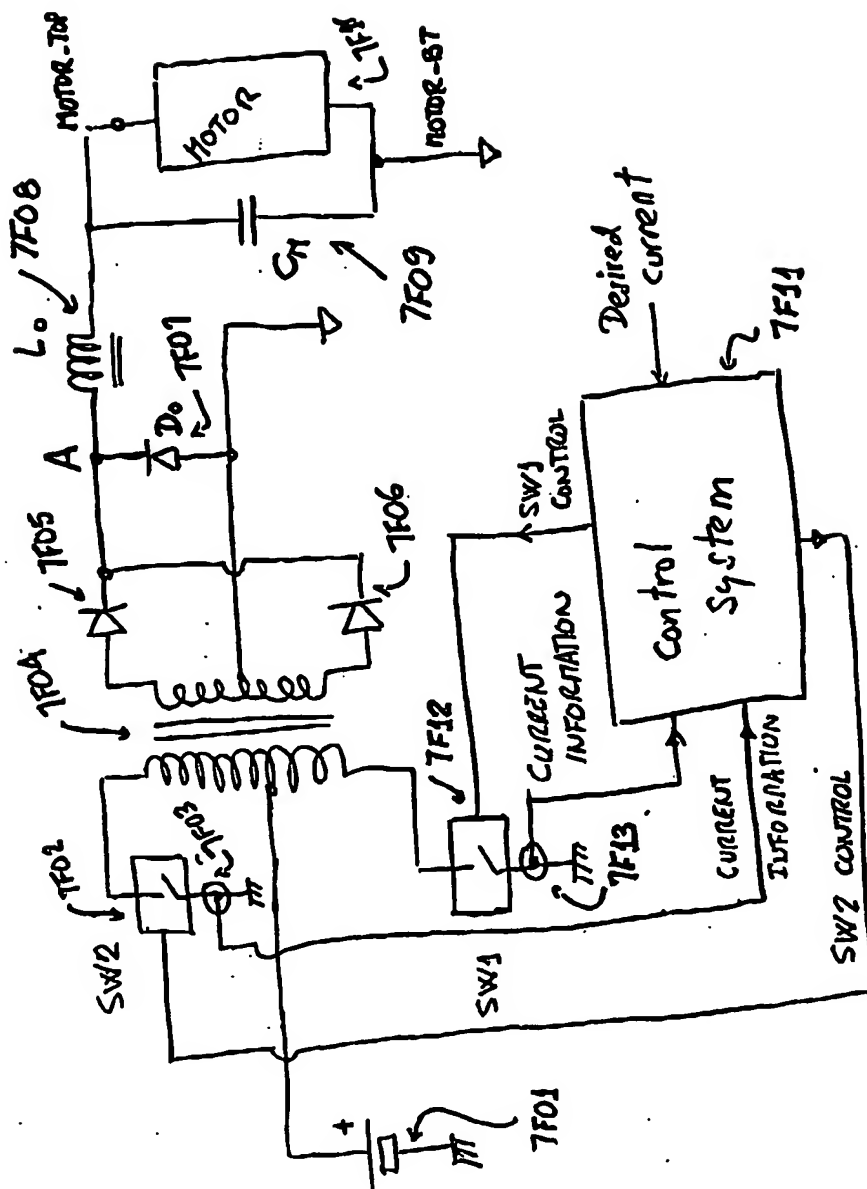


Fig 7C  
With Synchronous rectification







DC  
Voltage  
Source

Fig 7F



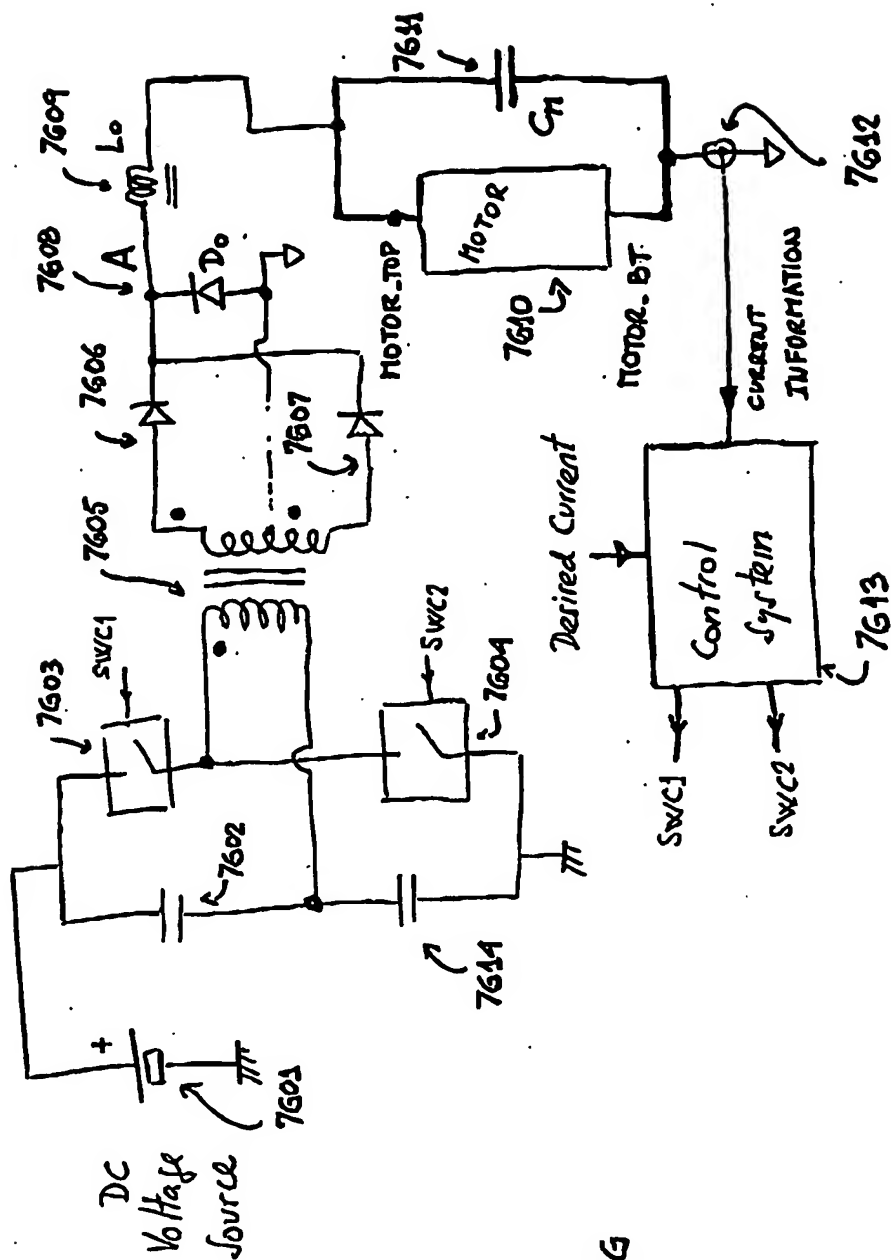
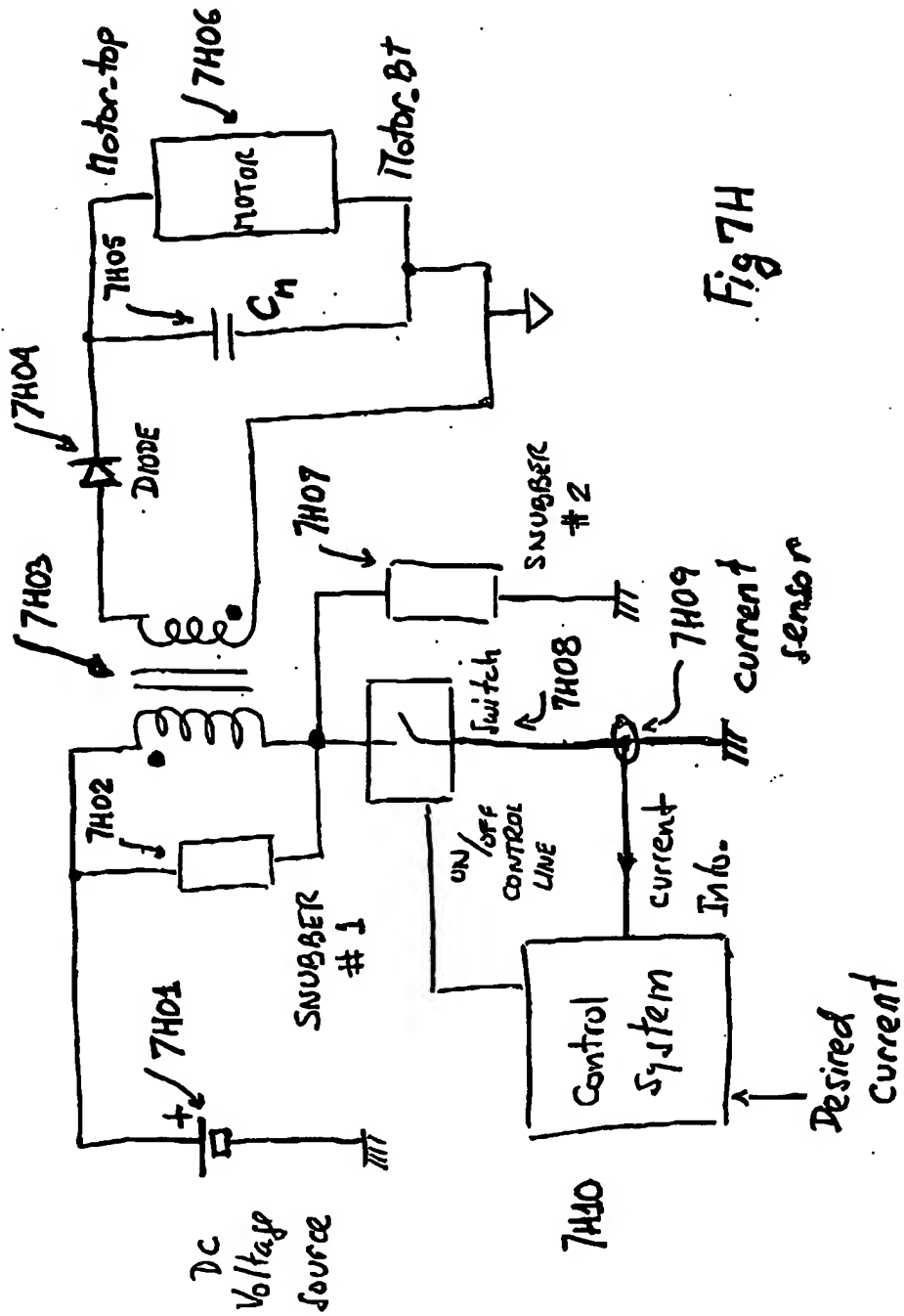


Fig 7G



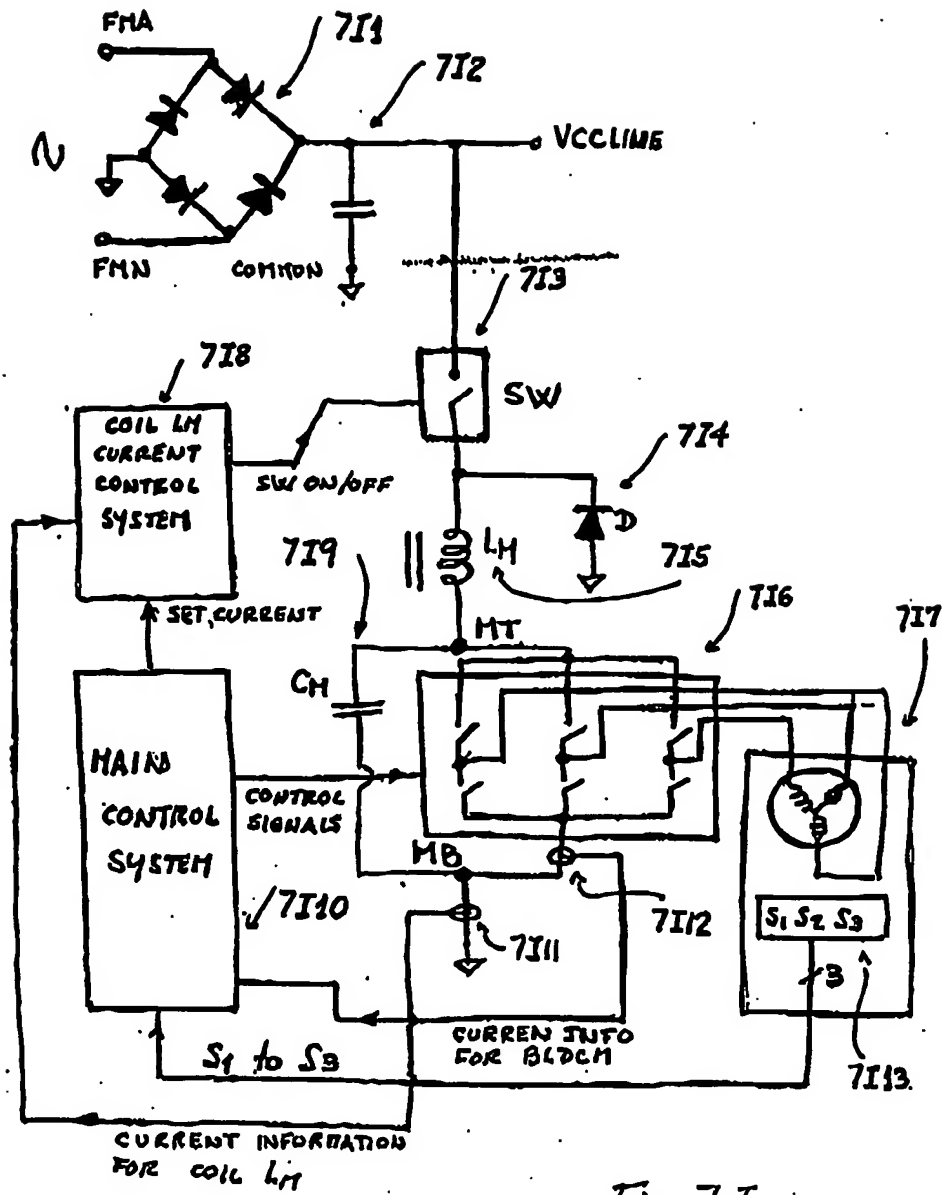
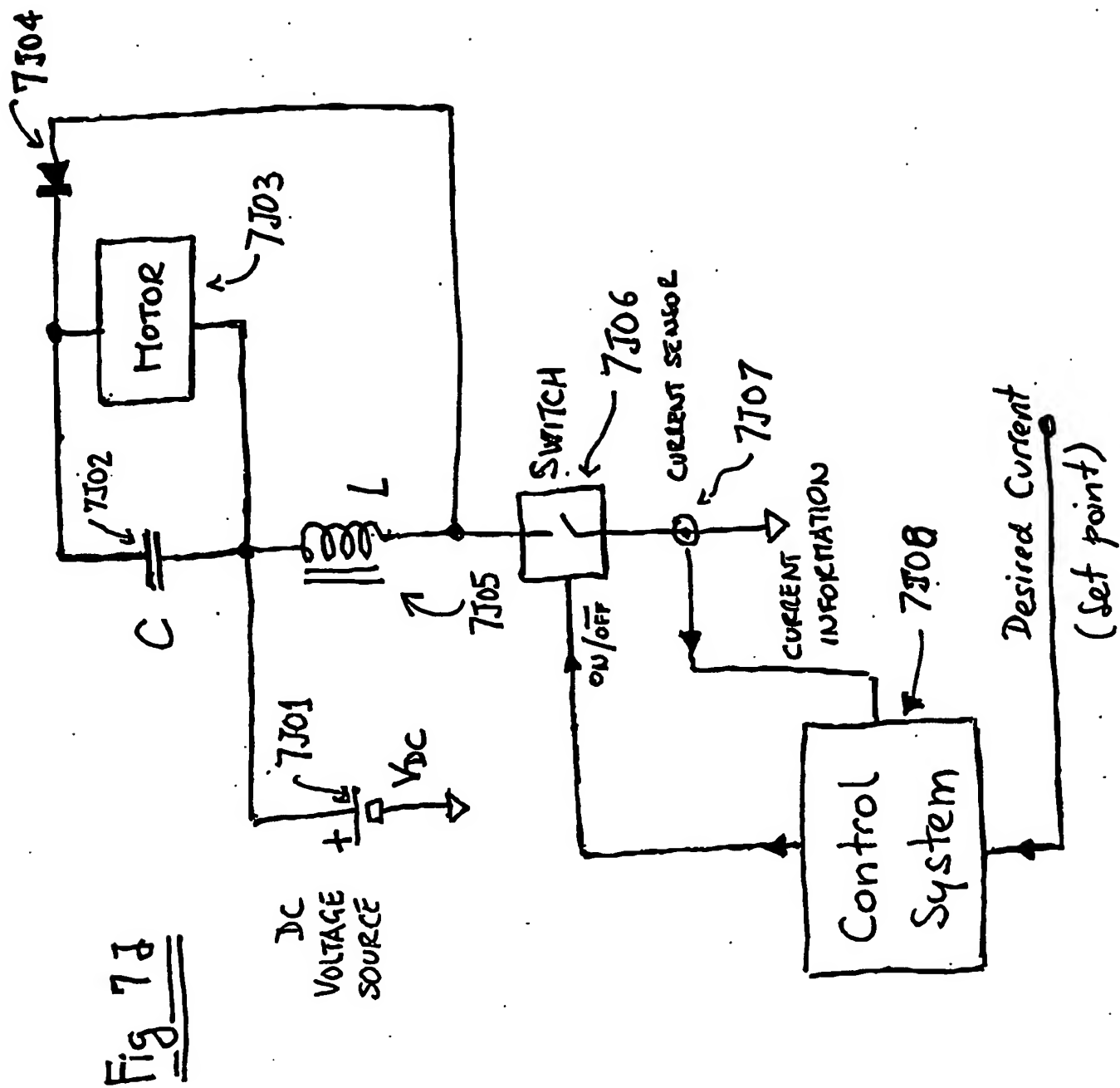


Fig 7I



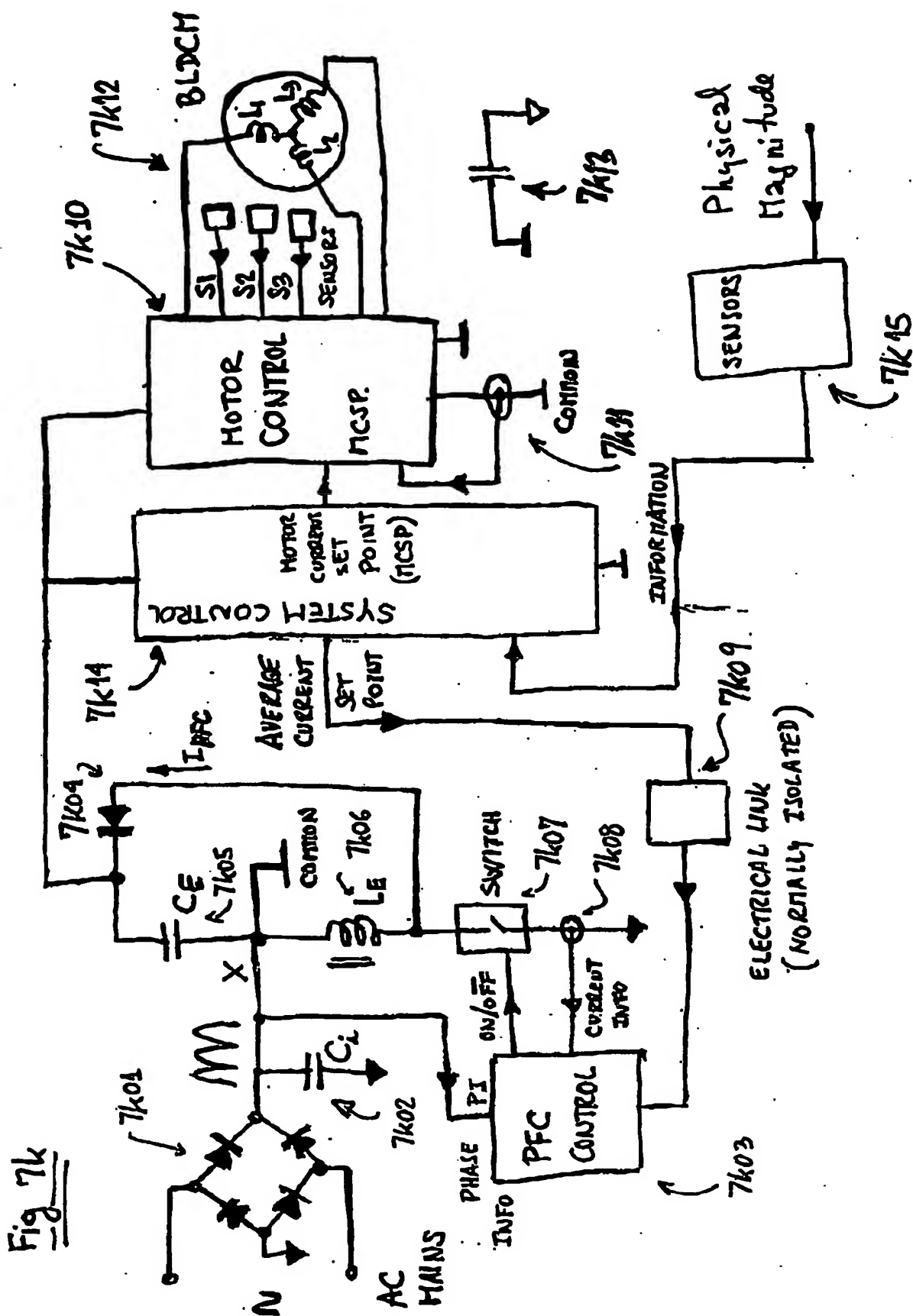


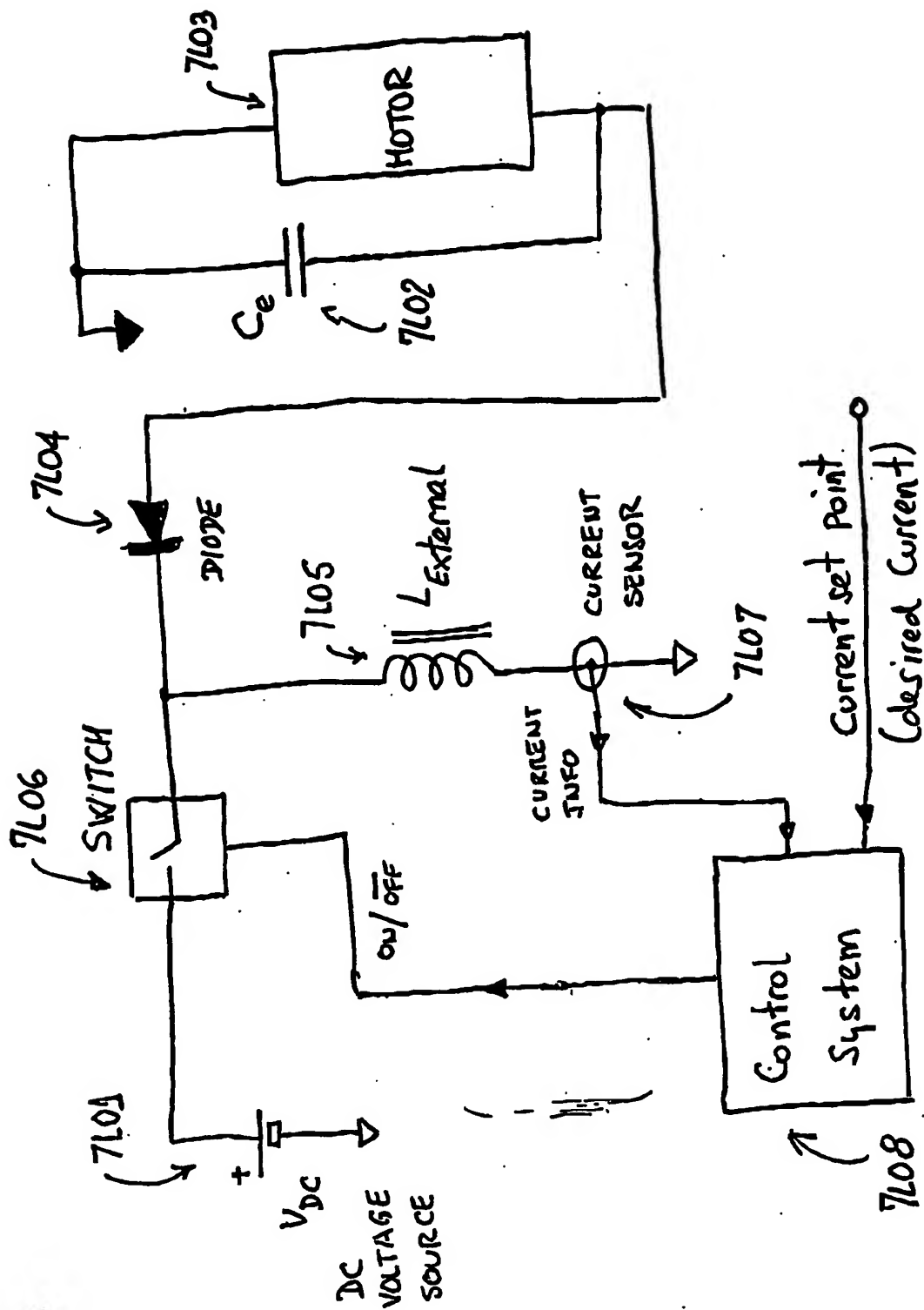
Fig 7L

Fig 8A

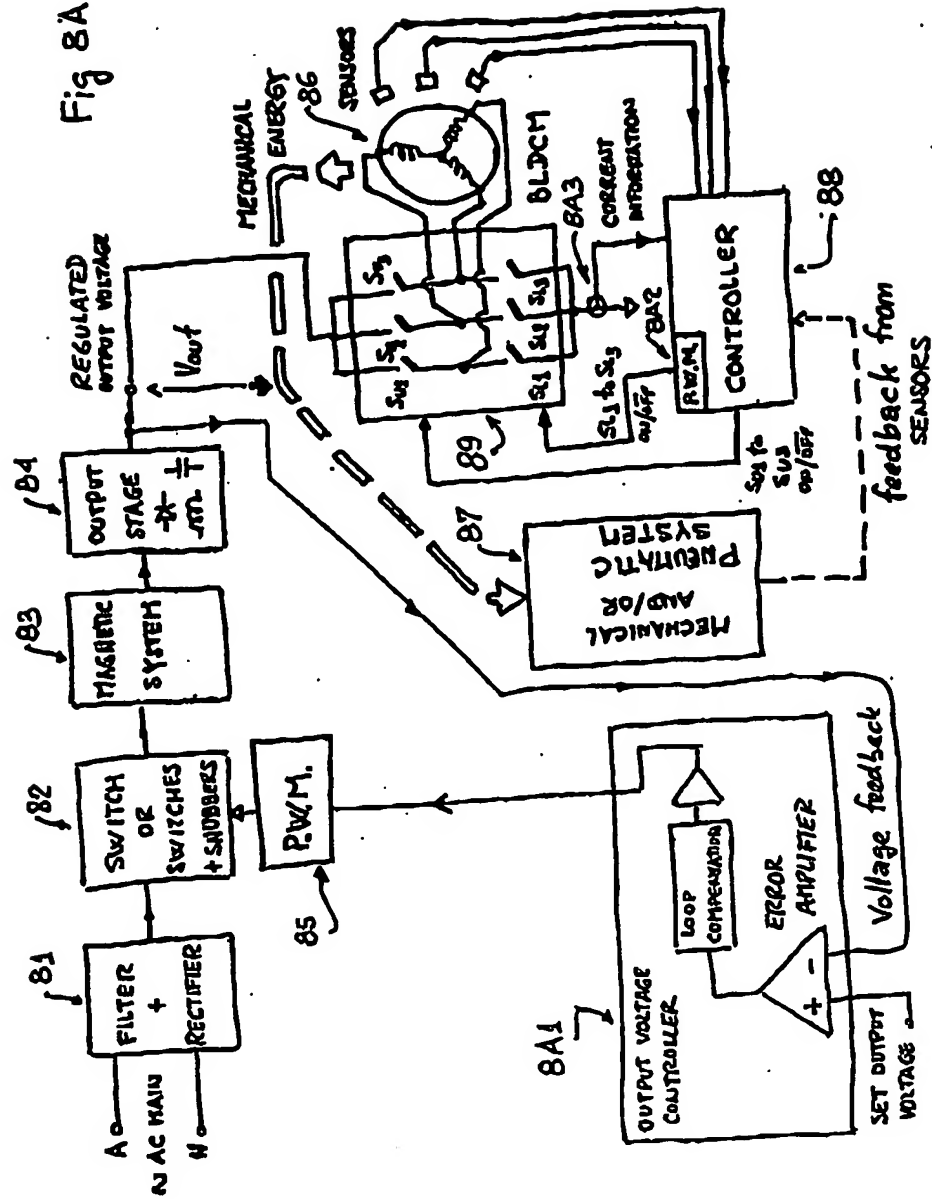


Fig 8B

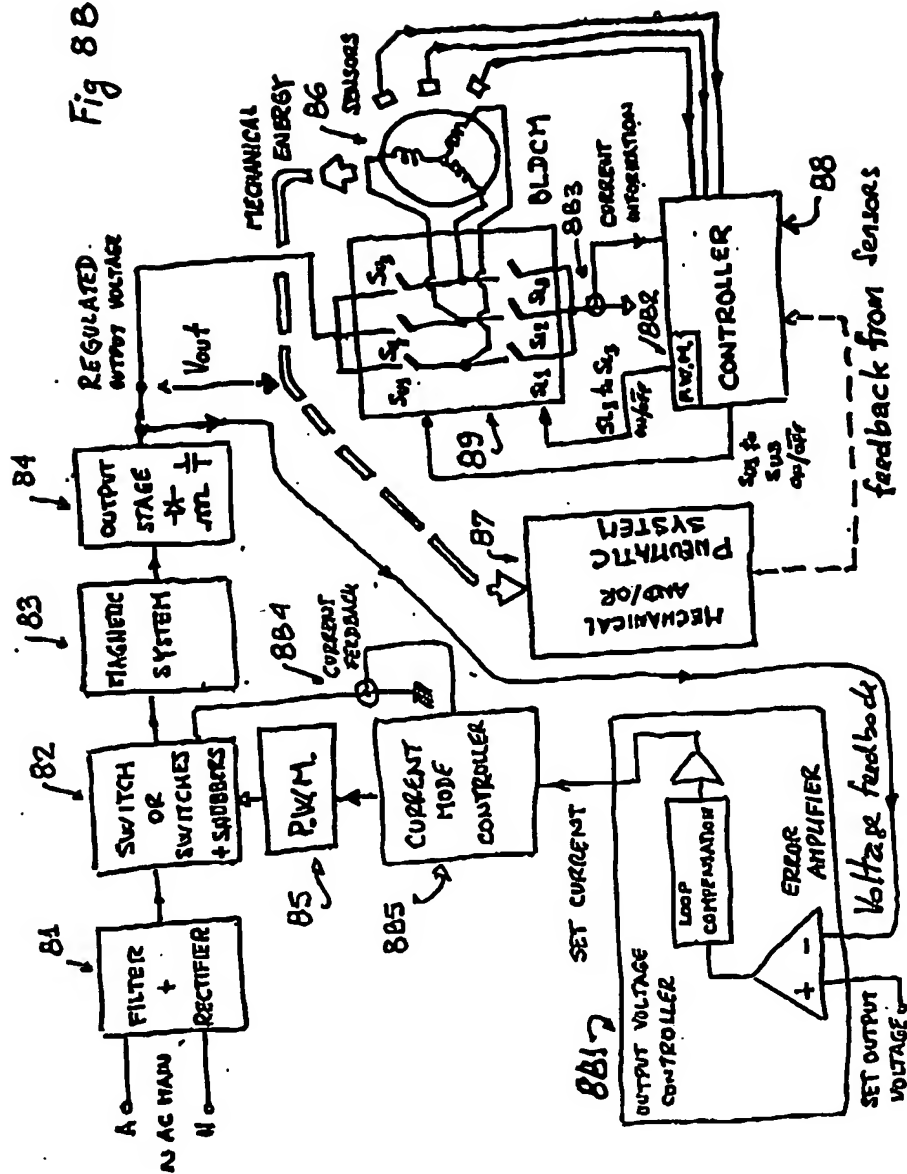
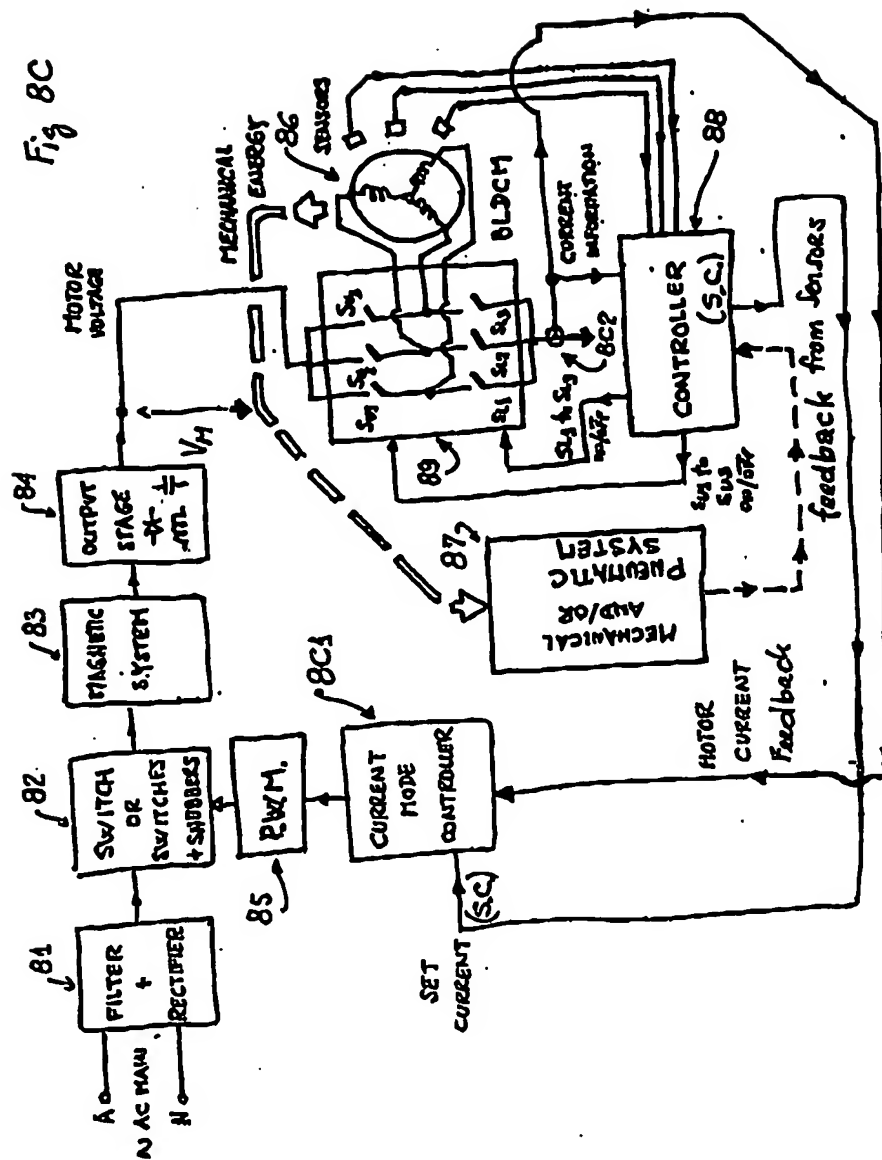
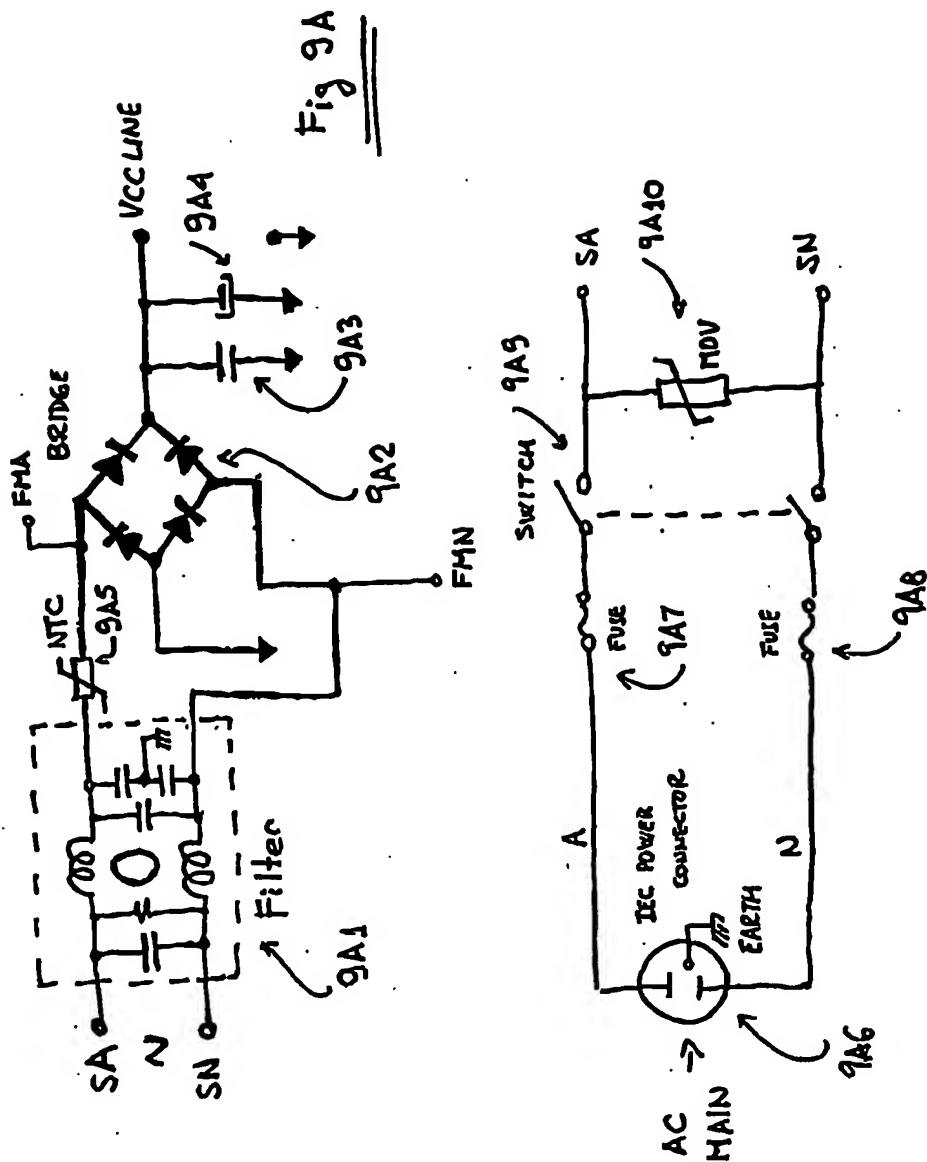
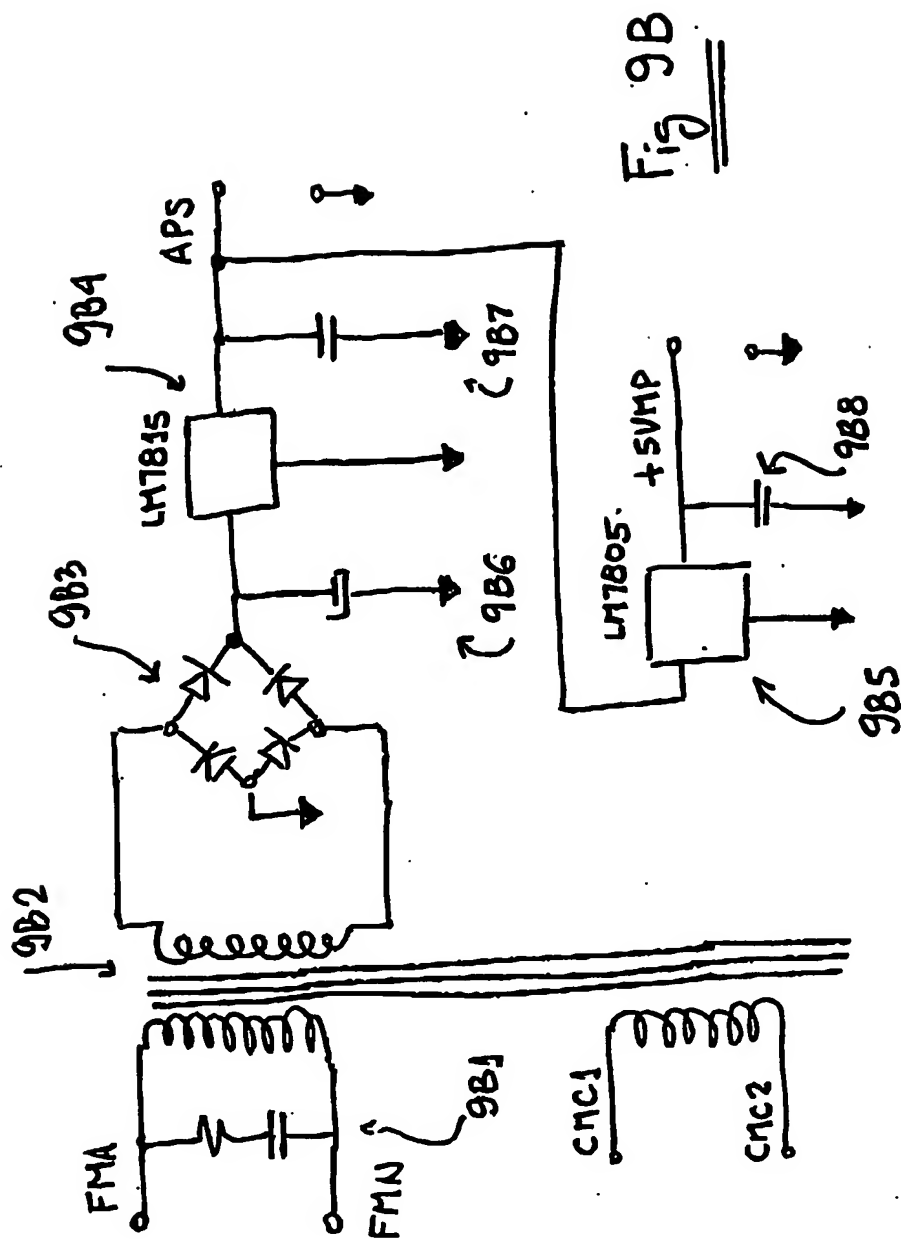




Fig 8C







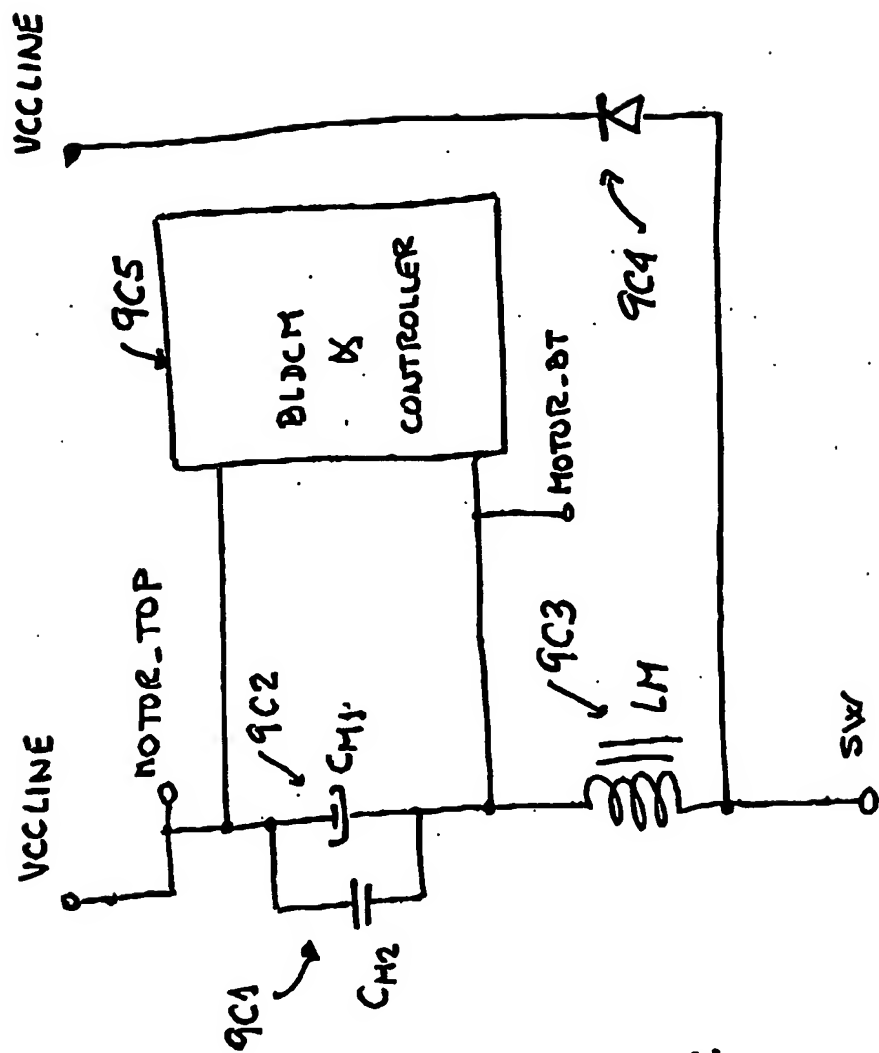


Fig 9C

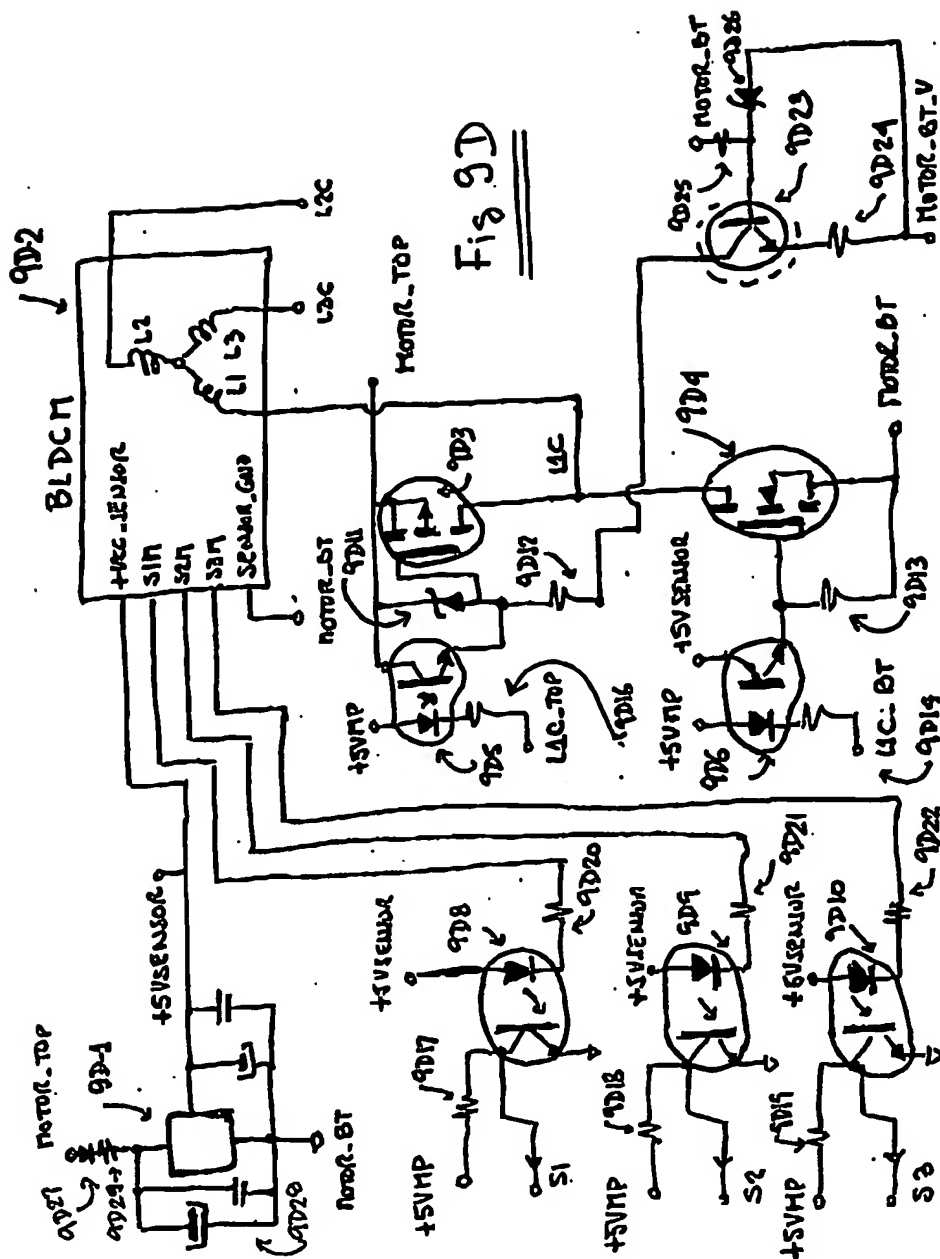
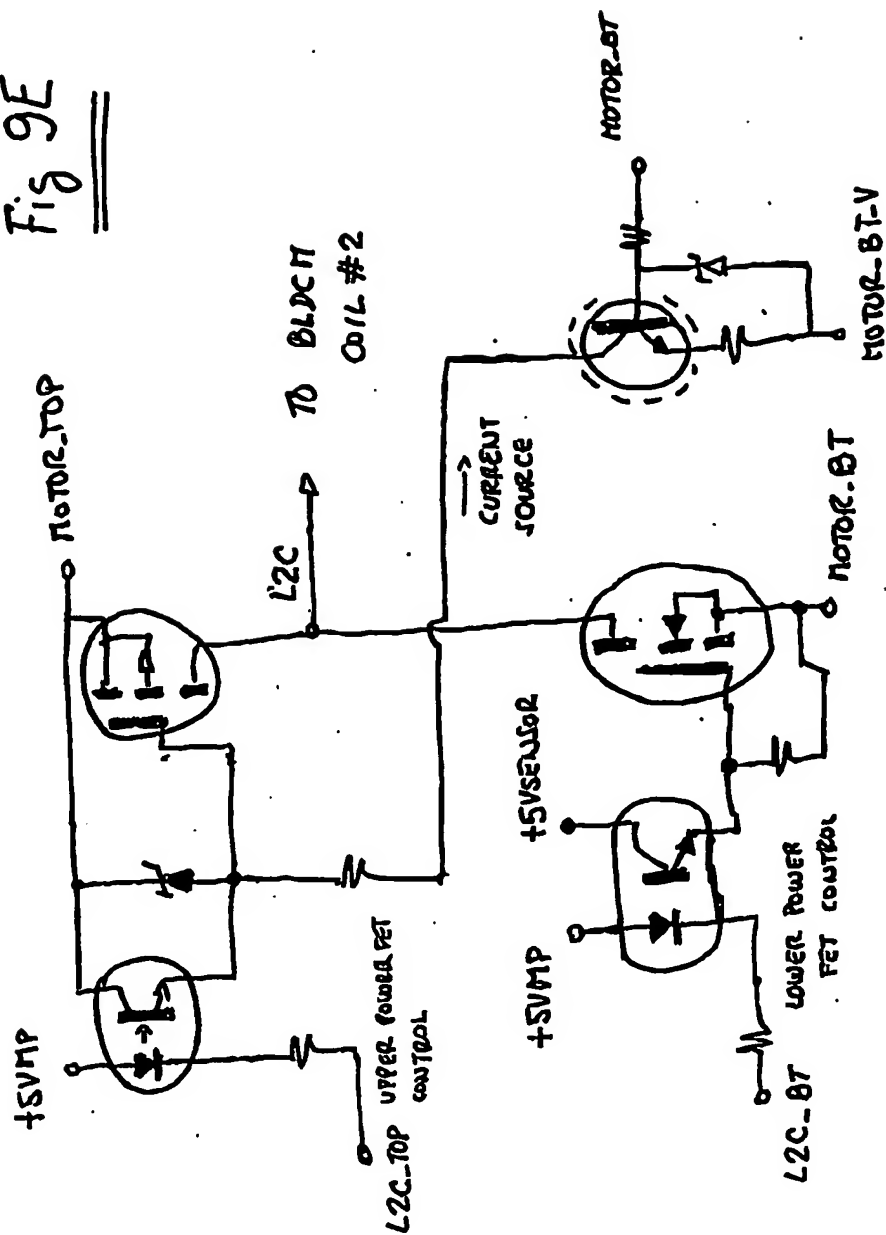


Fig 9E





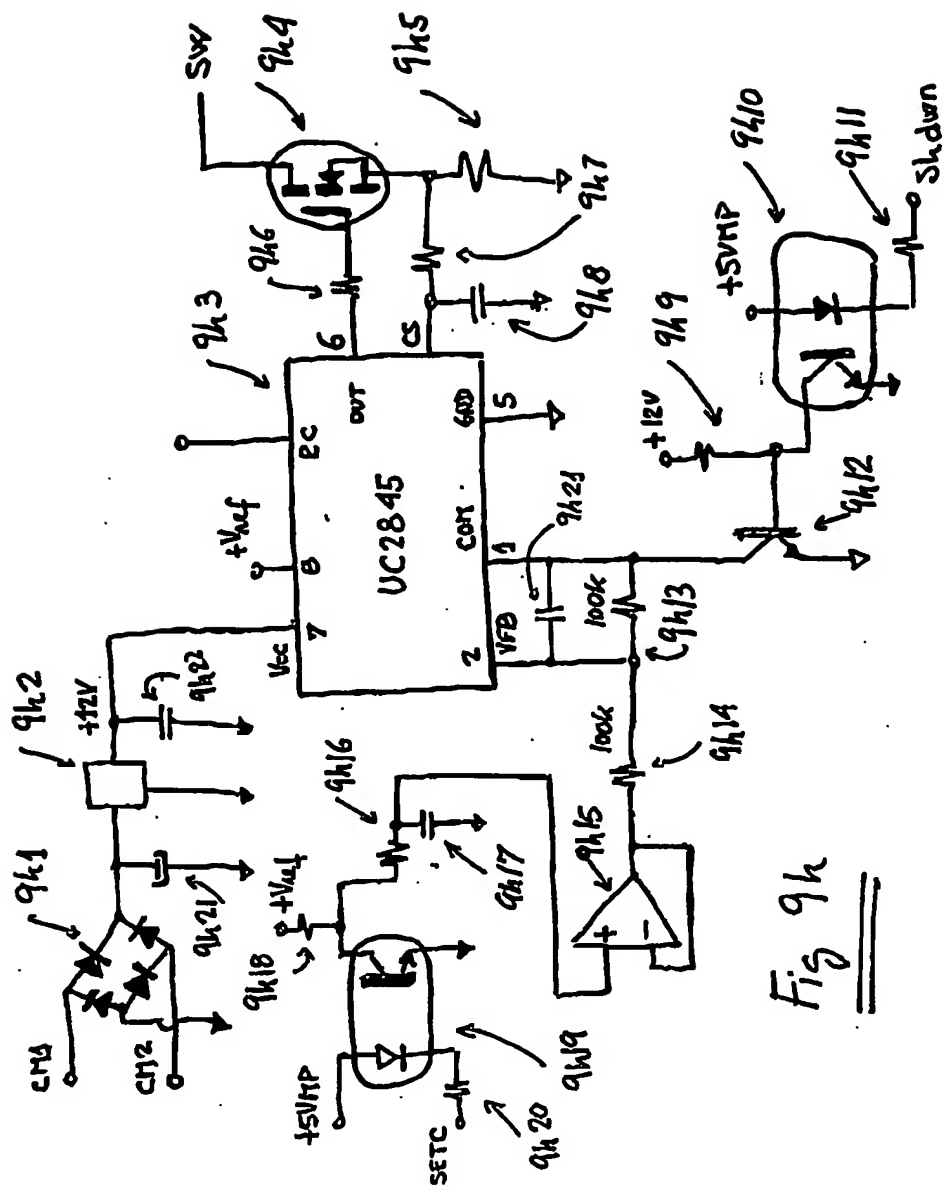
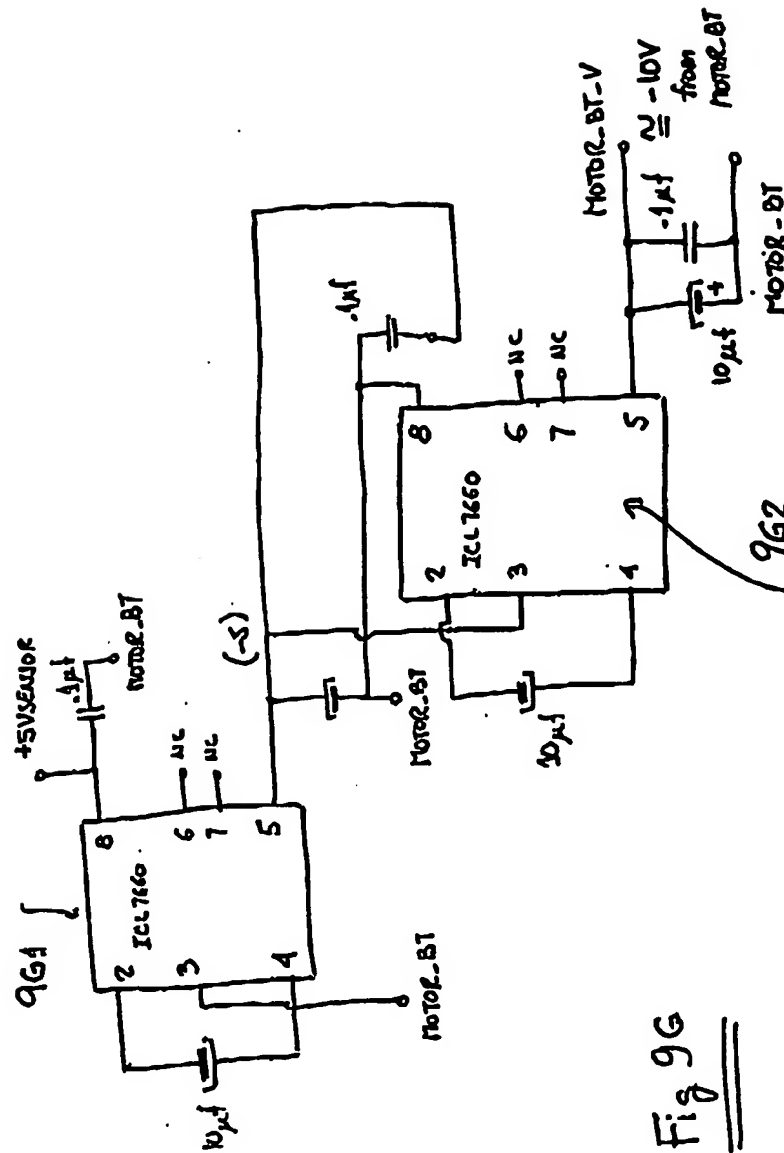
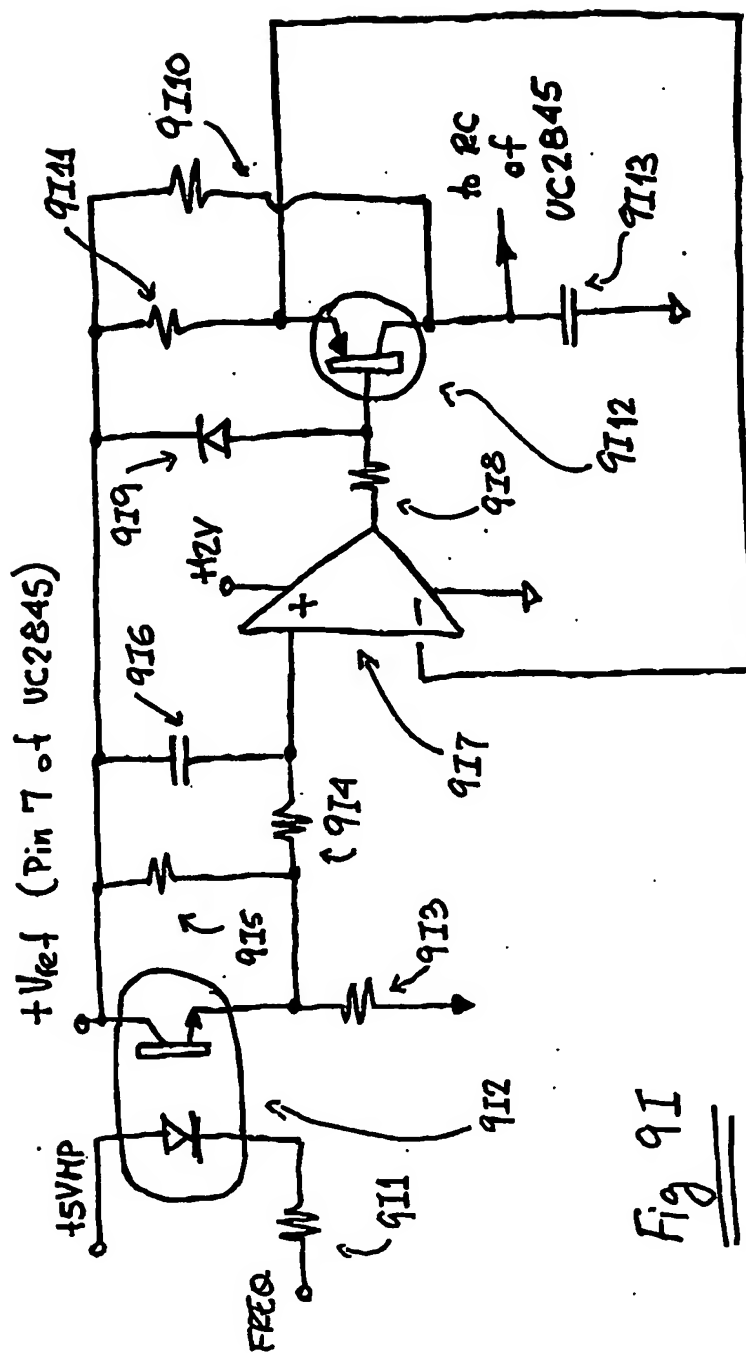
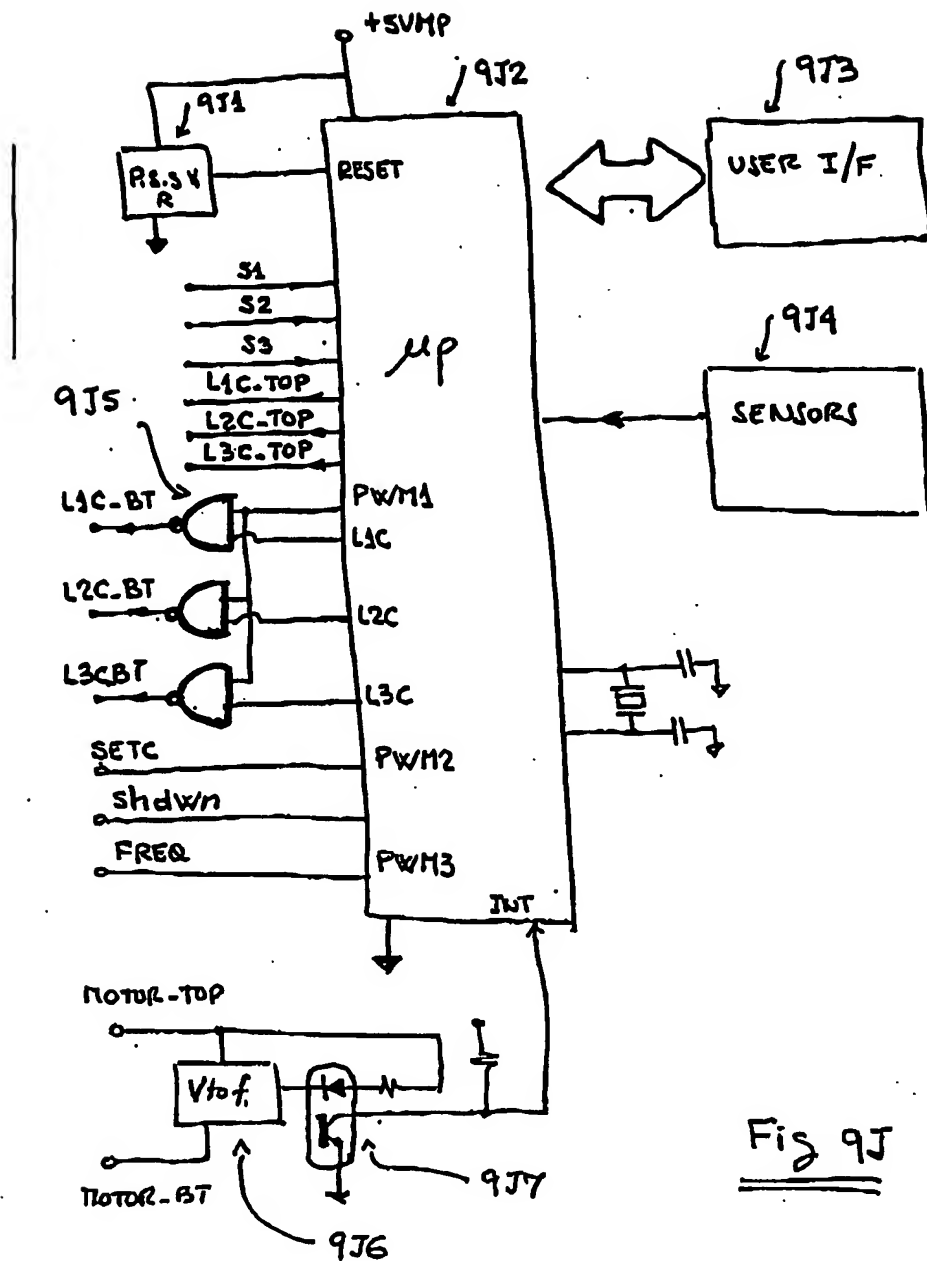


Fig 9k







Fig 9J

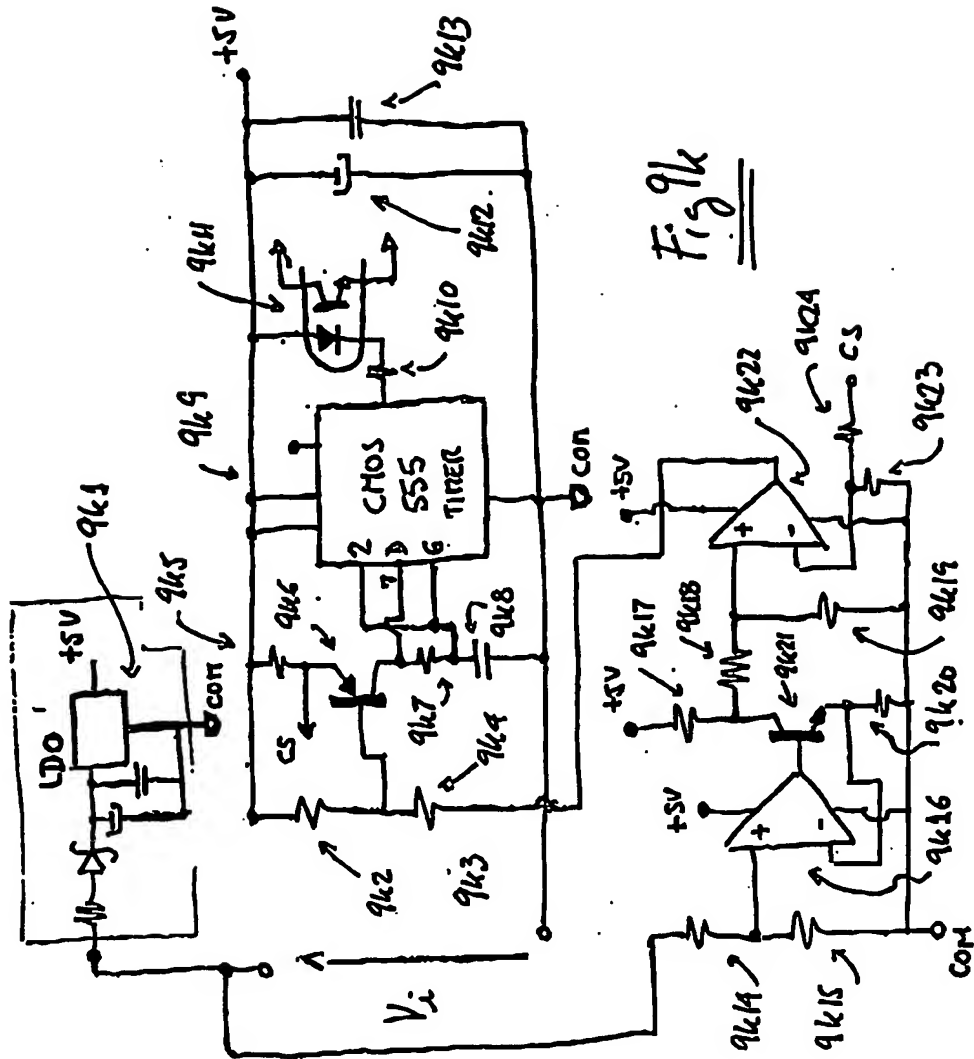
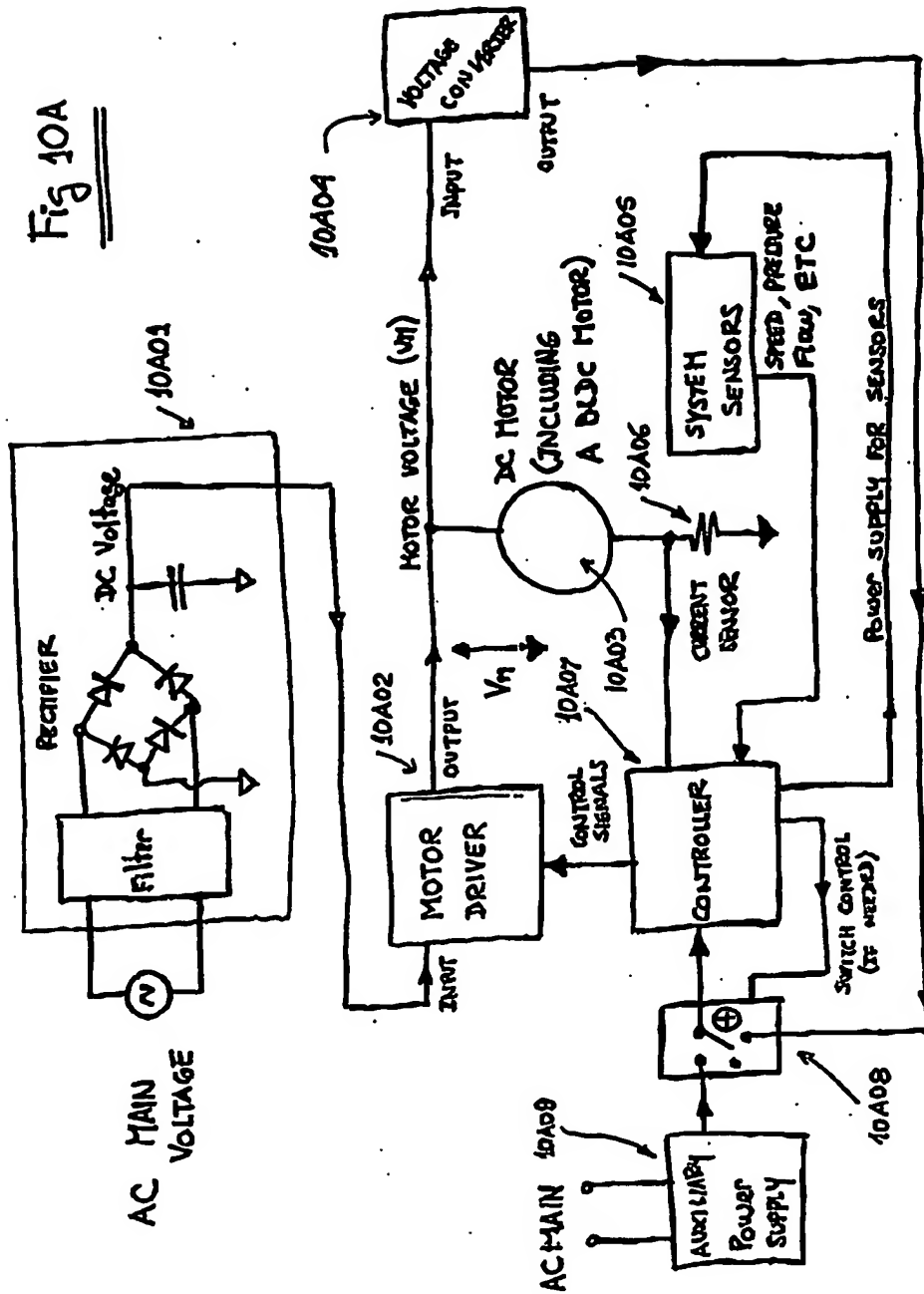
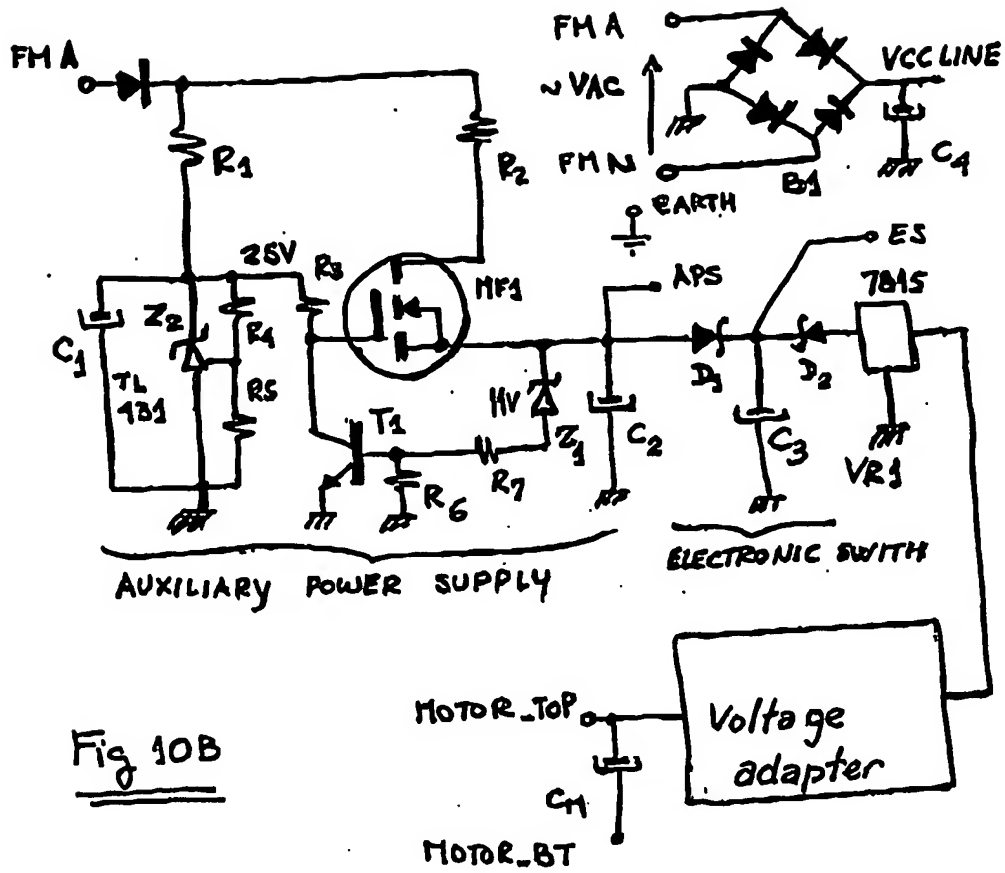
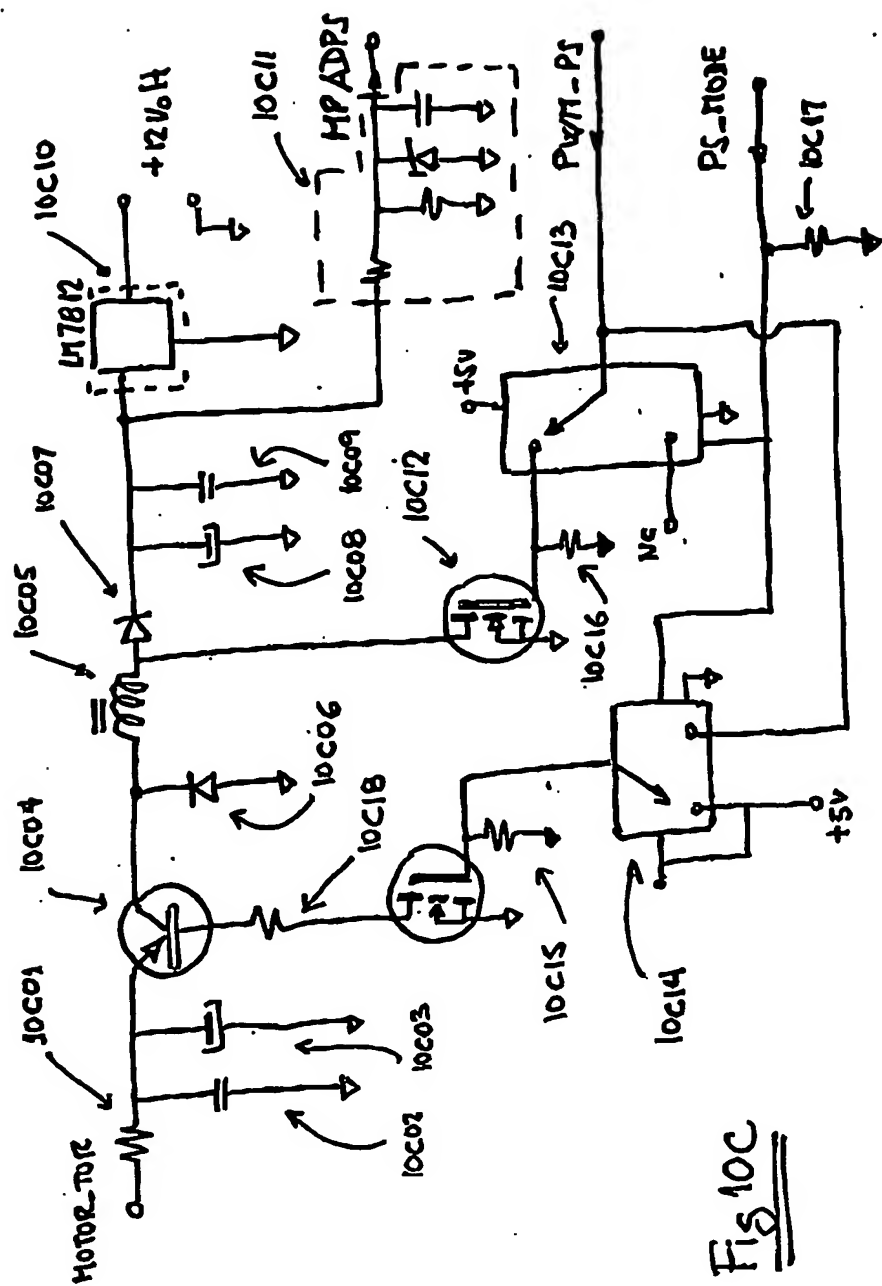


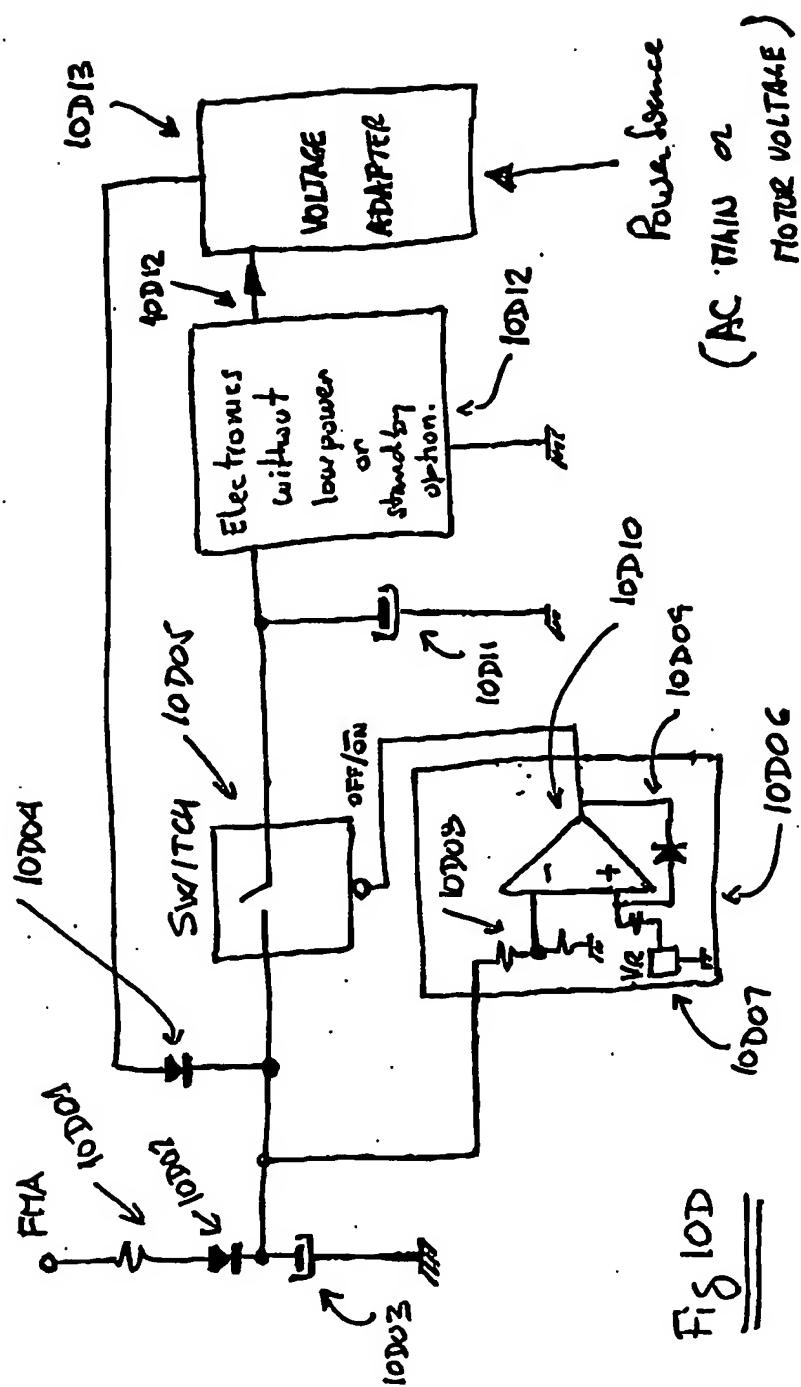


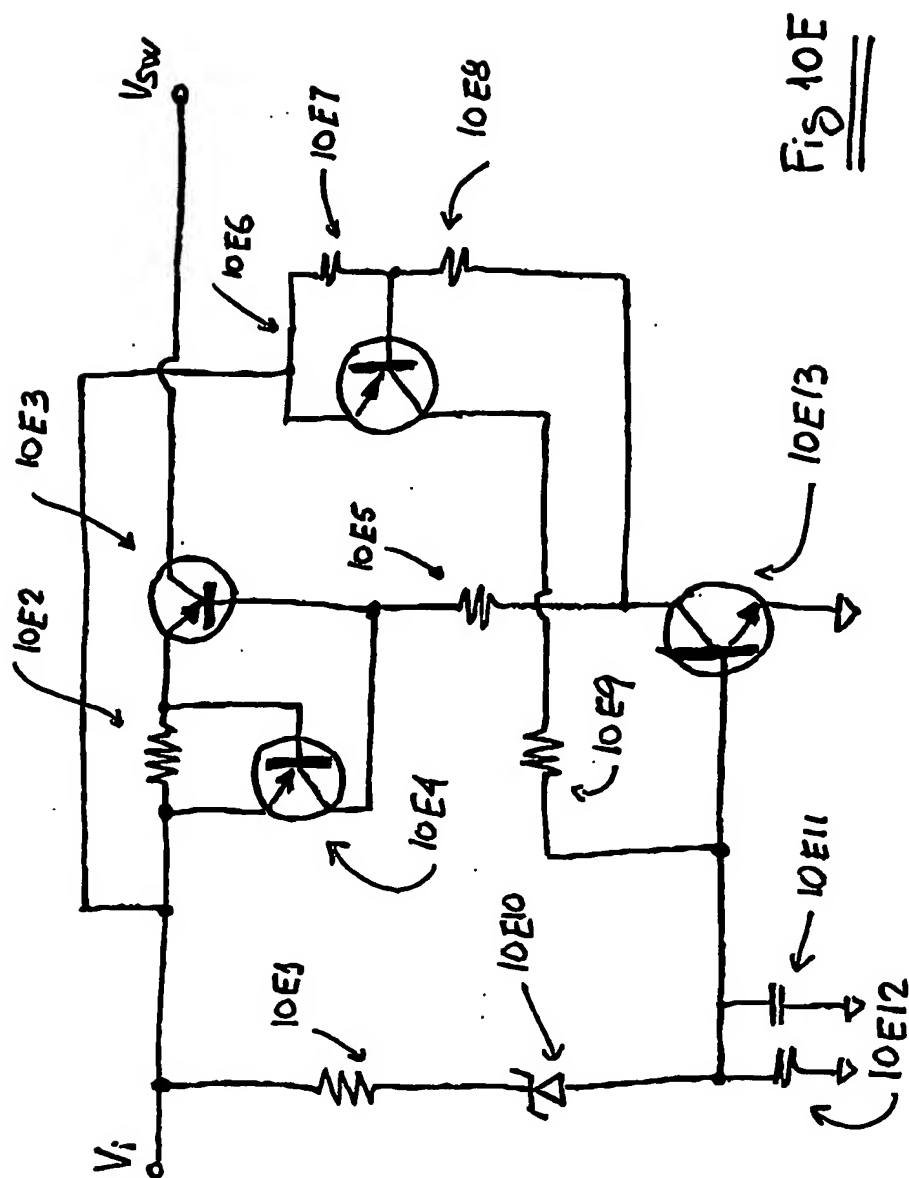
Fig 10A

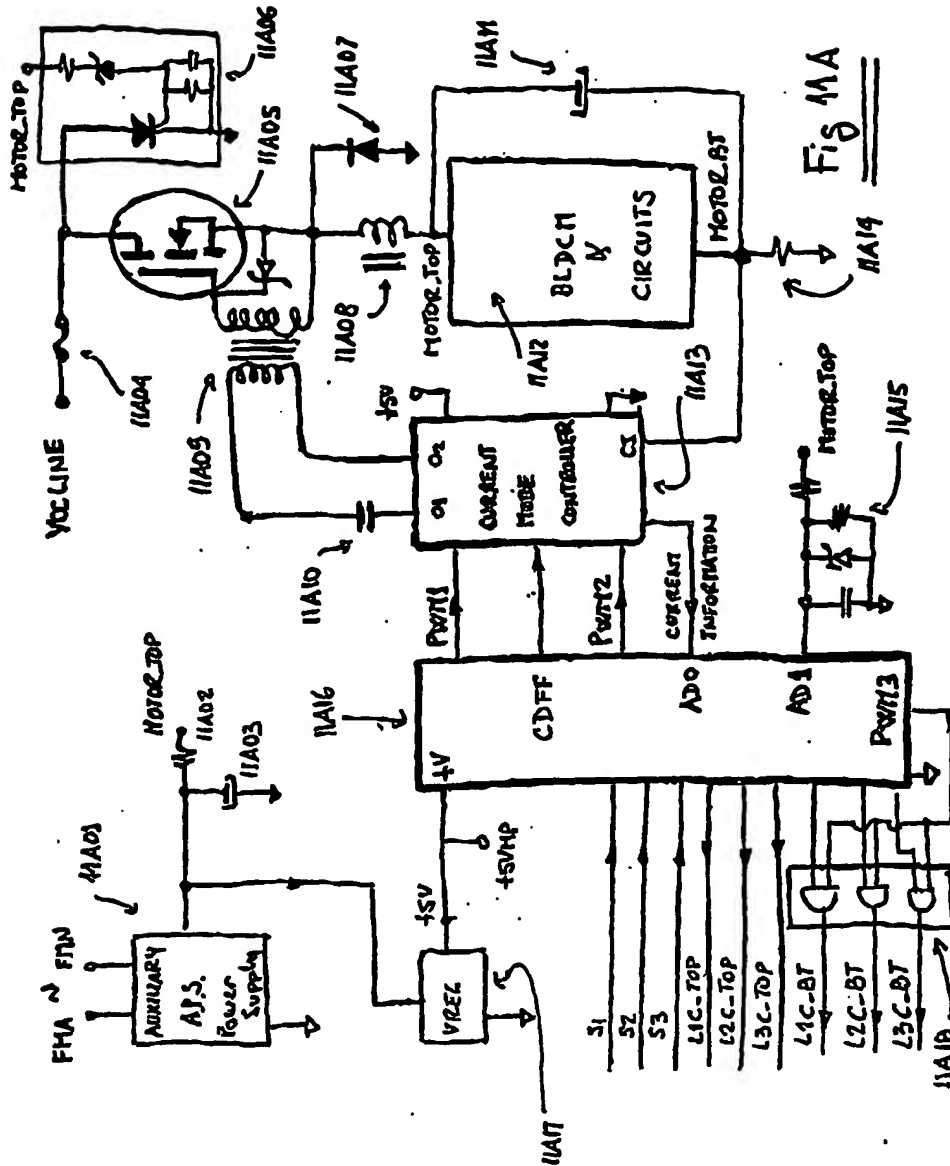


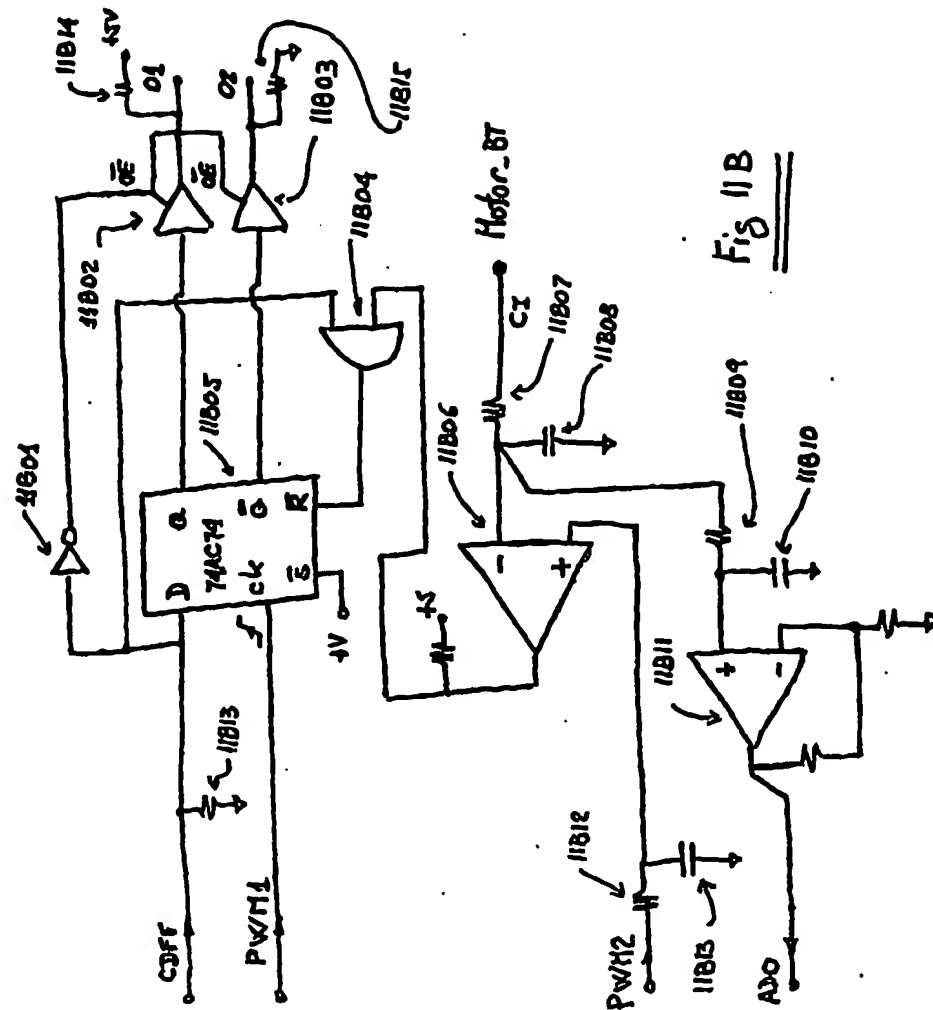












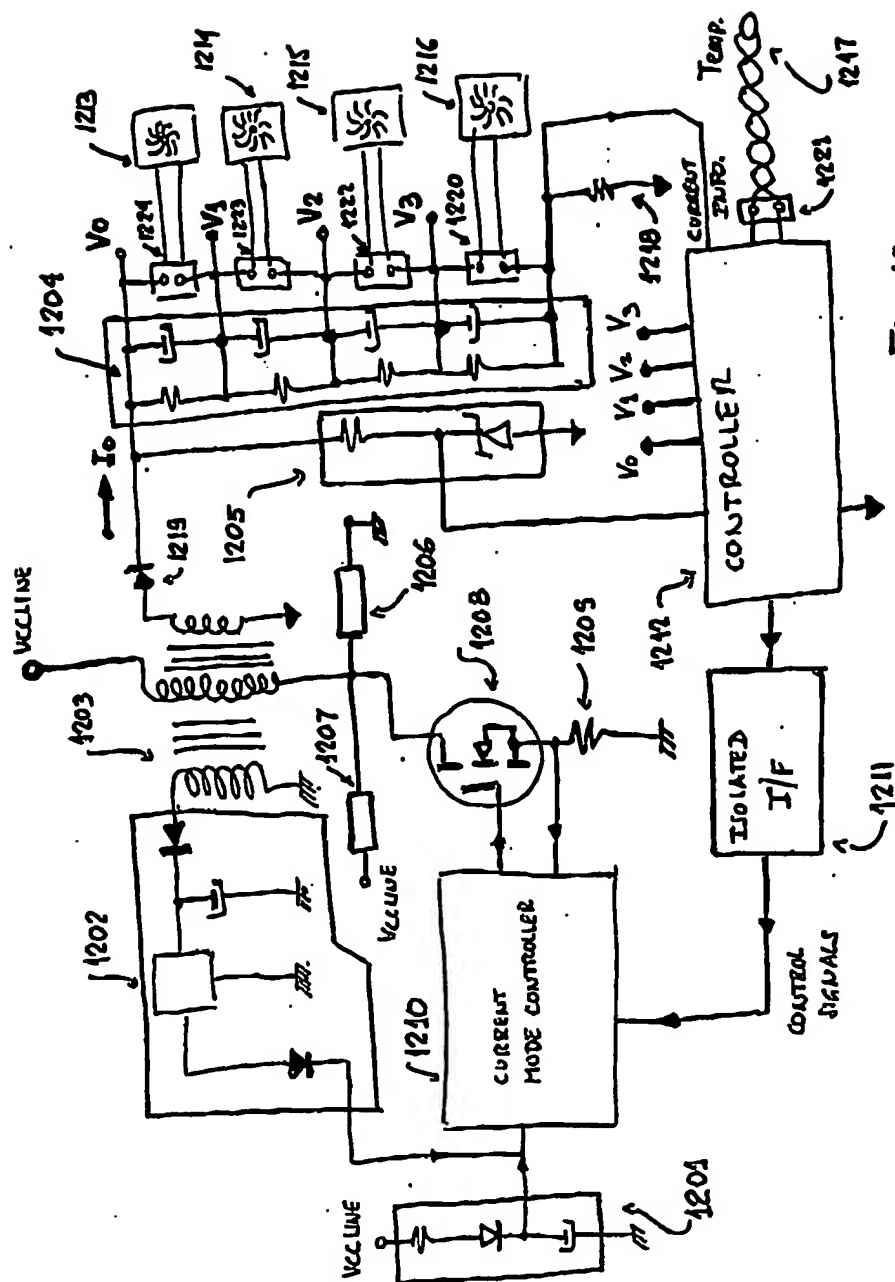
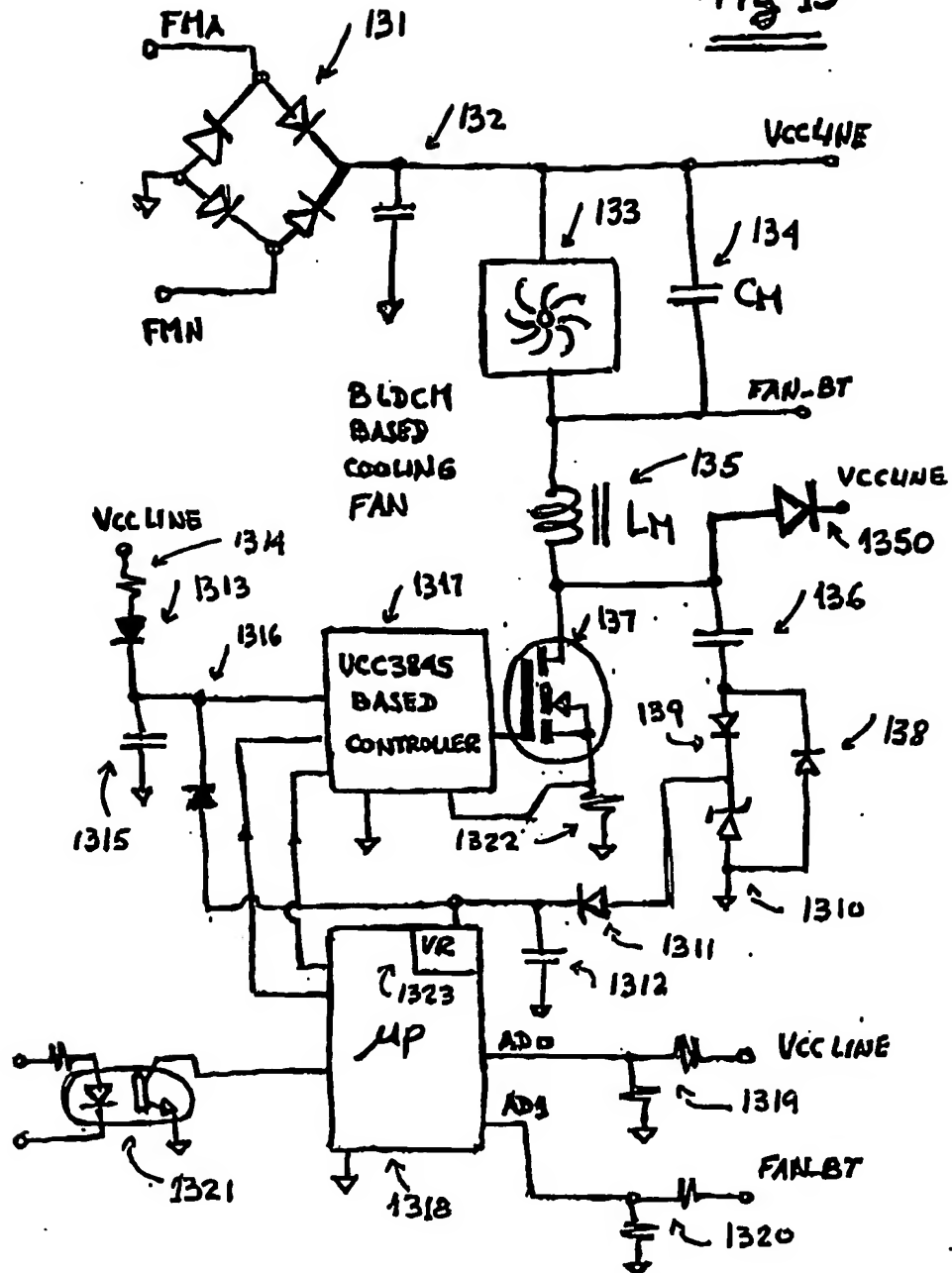


Fig 12

Fig 13

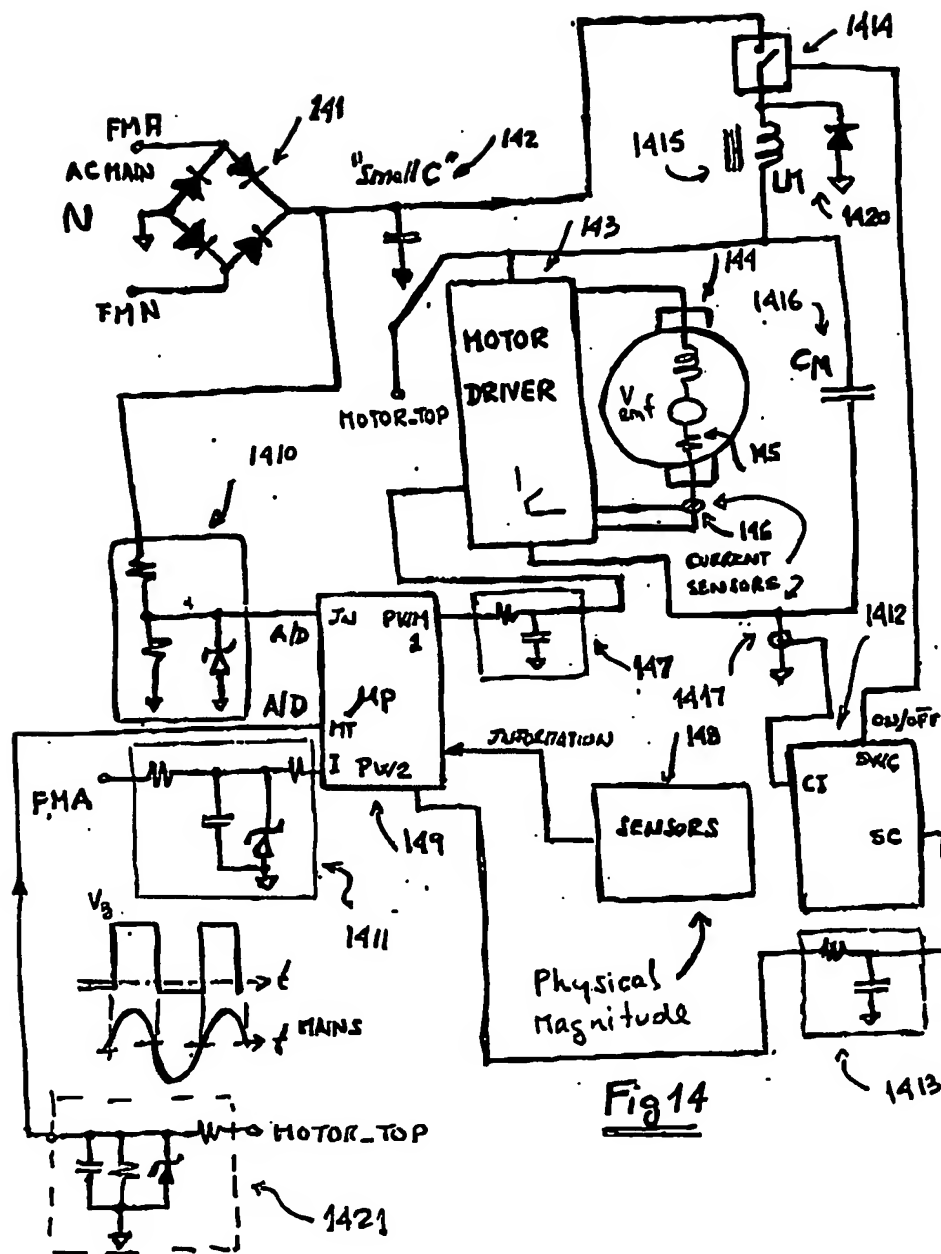






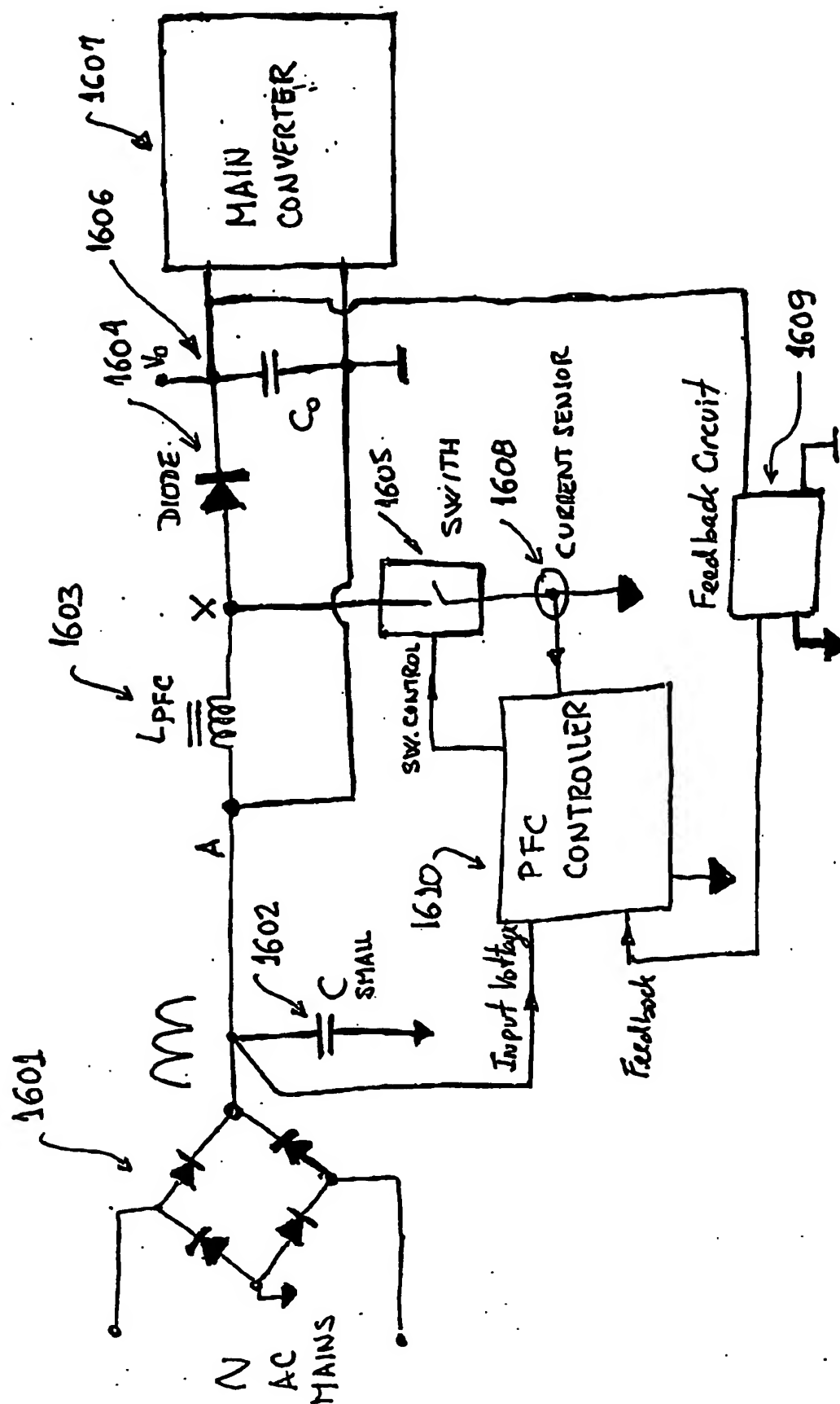
Fig 16



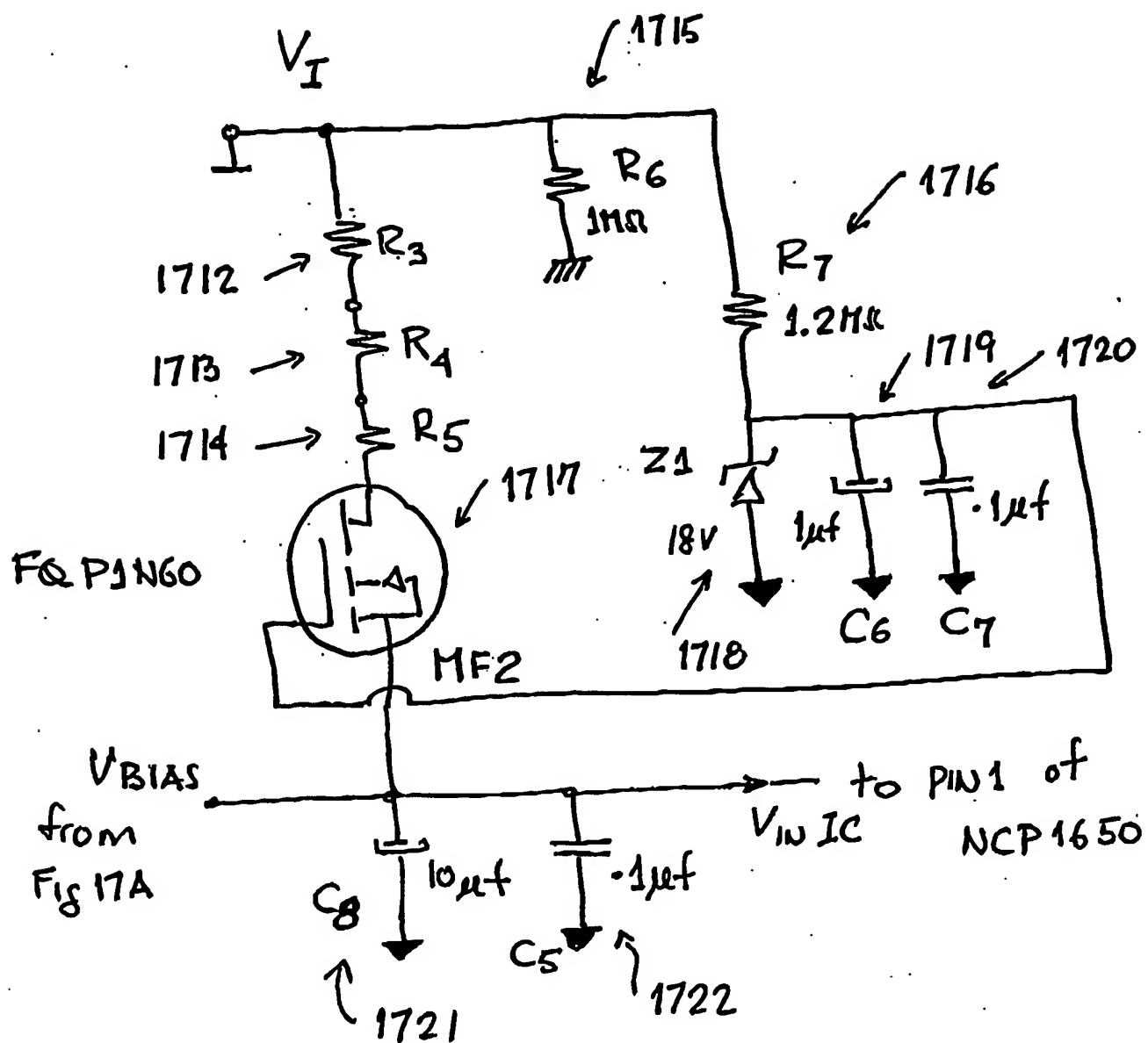
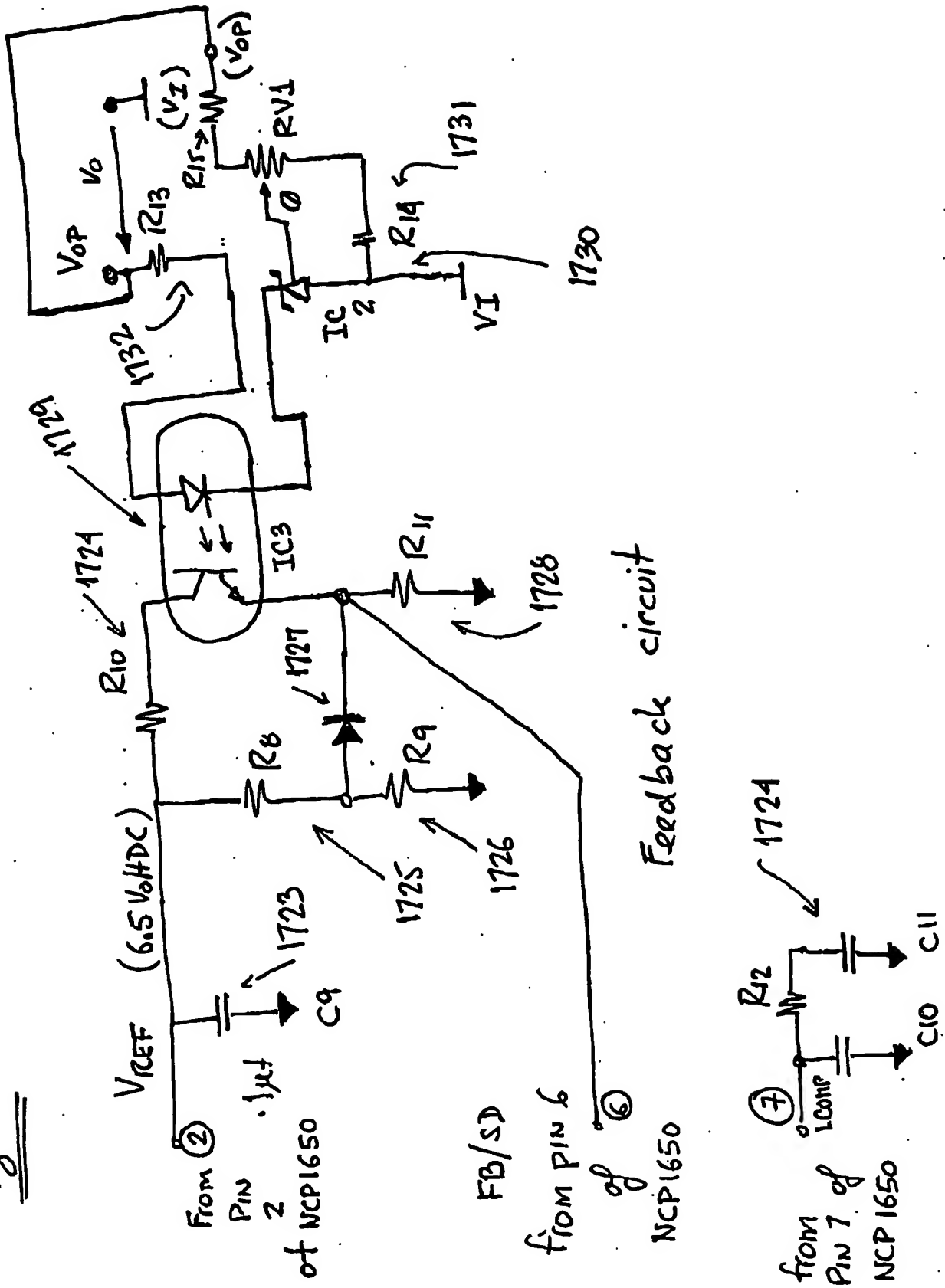
Fig 17B

Fig 17C



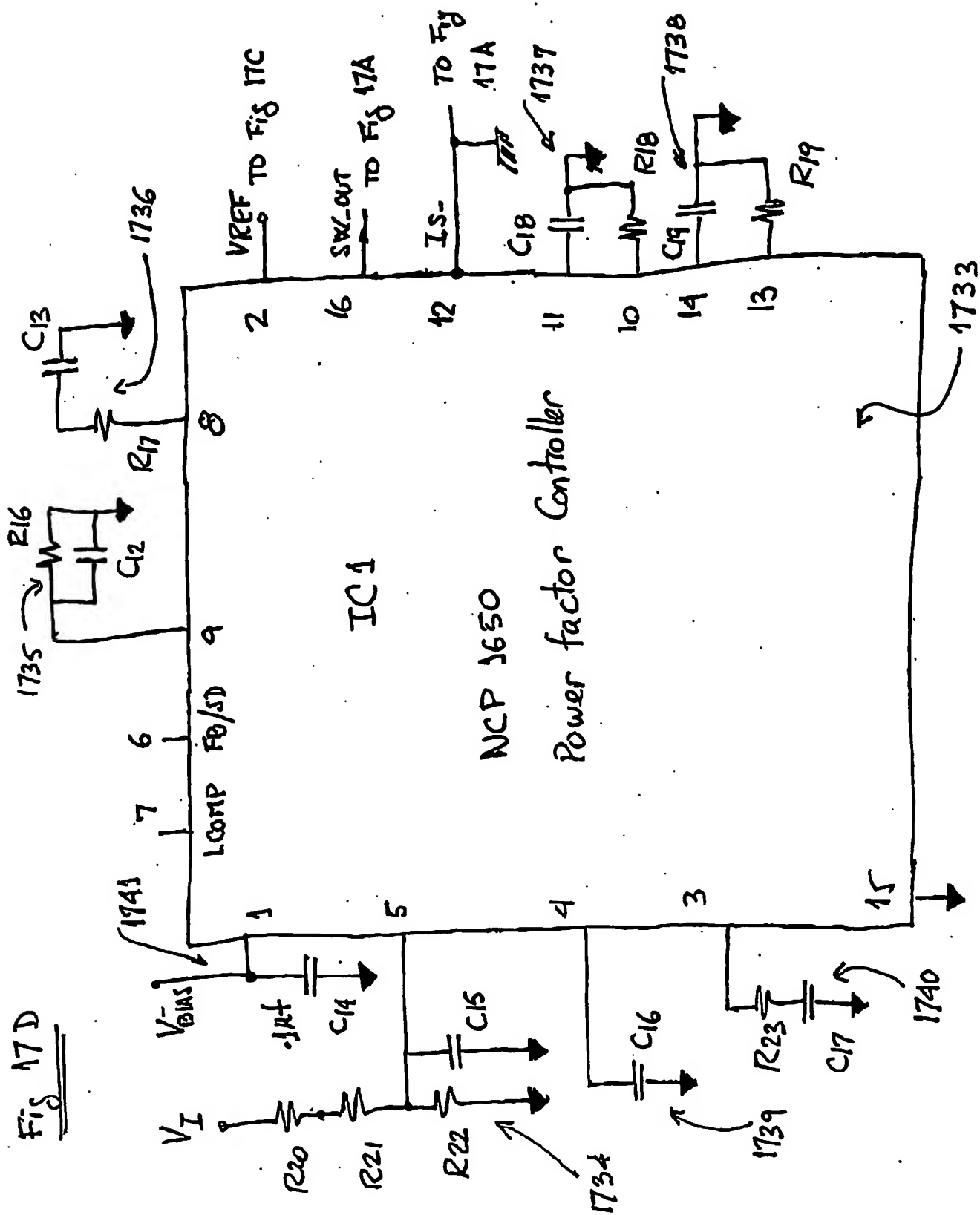
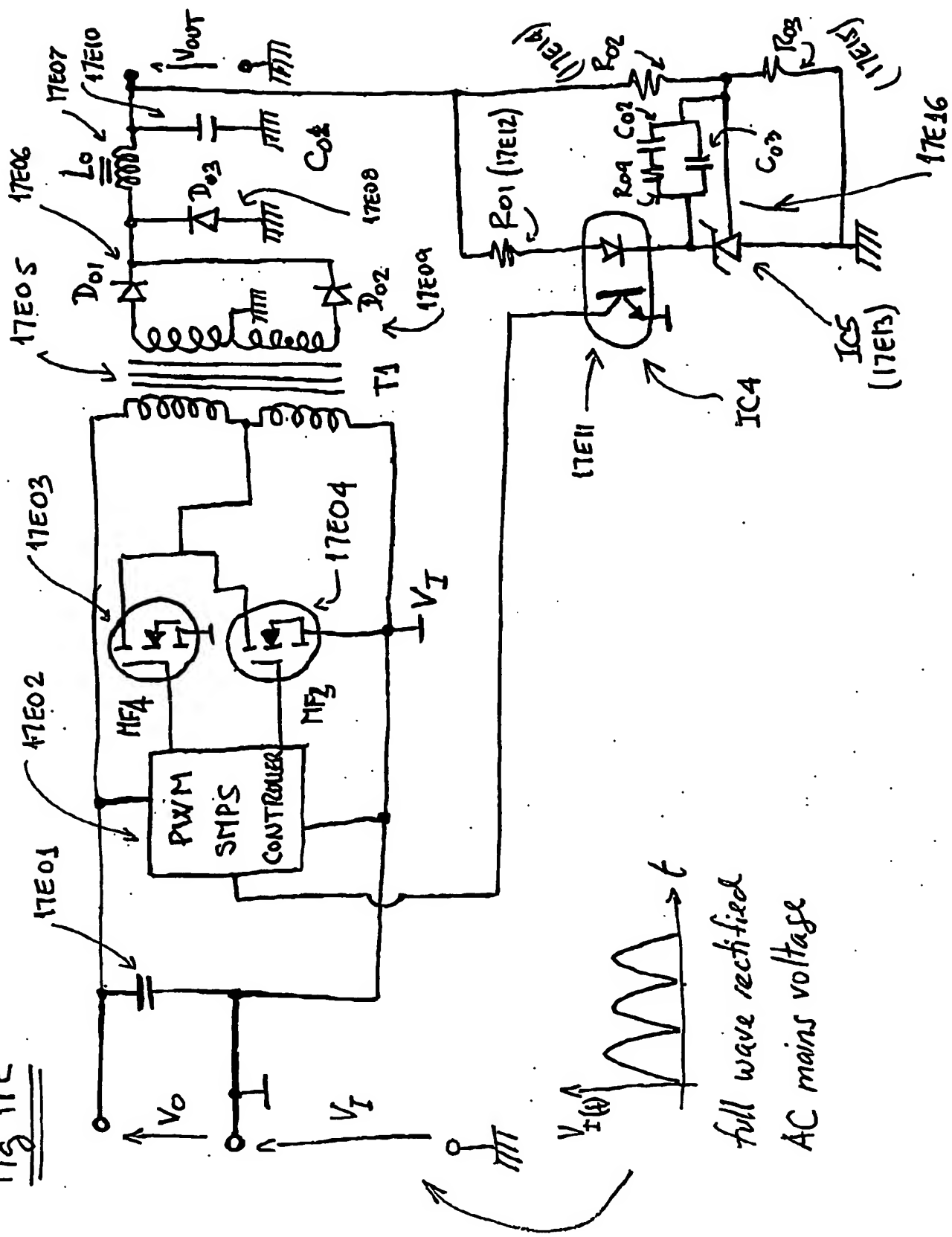


Fig 17E





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